Dial Indicators / Test Indicators

CATALOG 76

AS BASIC TO DIMENSIONS . . .

. . . AS A WATCH IS TO TIME

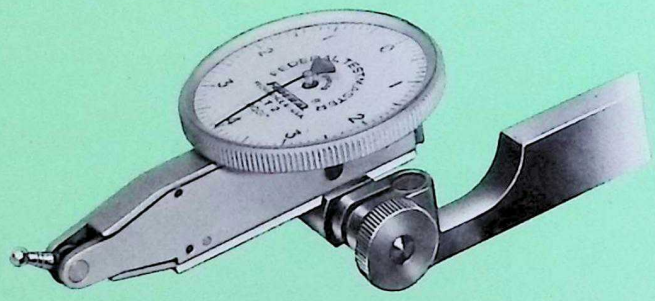
FEDERAL®
AN ESTERLINE COMPANY

DIAL INDICATORS

This Catalog

illustrates the most extensive line of Dial Indicators, Test Indicators and associated equipment available. If you should fail to find what you need, please write. Federal makes so many special and modified items, it is not practical to show them all.

For Catalogs of other Federal equipment, see inside back cover.



TEST INDICATORS

The following trade names and their associated marks, as used in this Catalog, are registered to Federal Products Corporation:

Federal
Miracle Movement
Testmaster
Eccentricator
Electricator
Micro-Sure

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AN ESTERLINE COMPANY

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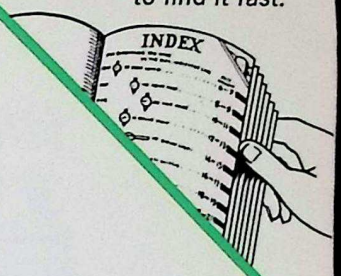
Use the markers to find it fast.



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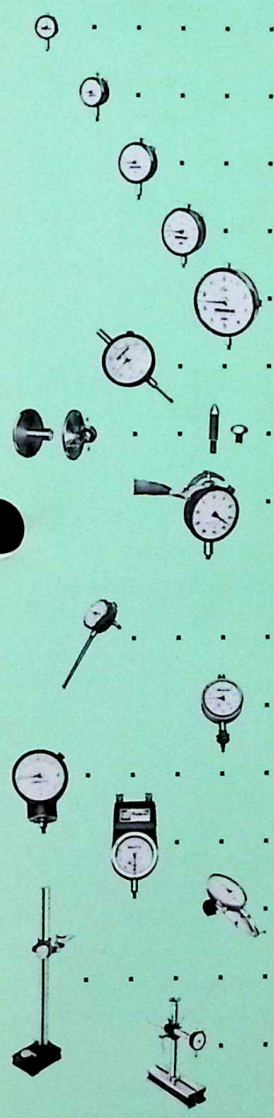
. . . for everything you need in Dial Indicators and Associated Equipment

English and Metric Models



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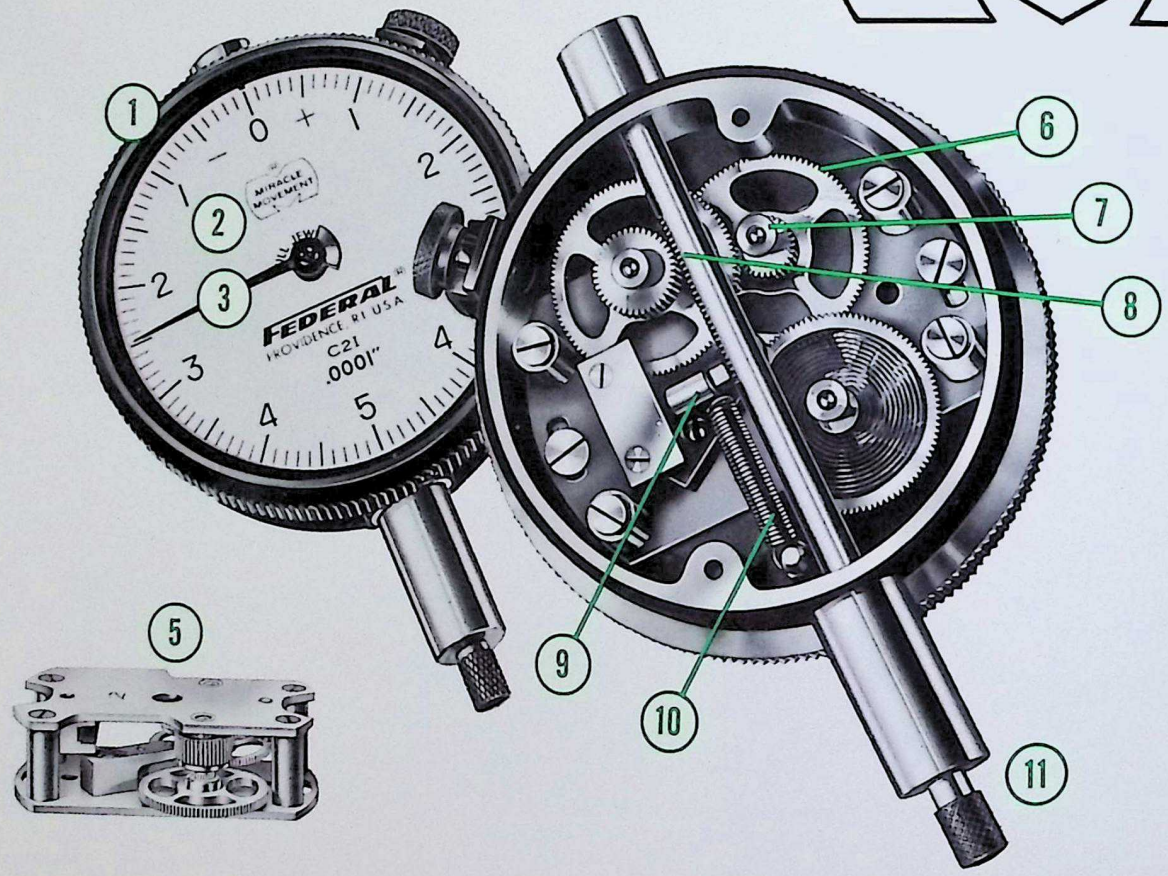
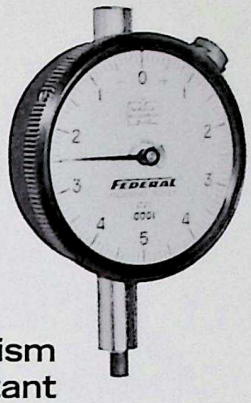
FEDERAL PRODUCTS CORPORATION

the SHOCK-PROOF MIRACLE MOVEMENT



1. Bezels of all Federal Indicators adjust smoothly to set zero, lock securely without shifting dial.
2. Dial is tinted green for easier reading of sharply defined, precisely spaced graduations.
3. Indicating hand is of special alloy steel to withstand great momentary flexing. It is precisely counter-balanced for low inertia response. Special clamping arrangement of hub and shaft prevents any chance of shift.
4. Crystal is shatterproof and curved to avoid glare.
5. Unit construction of movement permits easy removal for cleaning. Heavy duty plates and spacers make movement rugged, rigid.
6. Stainless steel gears, rack and pinion are precisely hobbed then tough hardened by special process which maintains their precise form, makes them truly wear-proof and shock-proof. Gears are skeletonized; no excess weight to impair sensitive response.
7. Jeweled bearings of hard, tough, man-made sapphire defy wear over millions of cycles, provide the lowest possible bearing friction.
8. Mesh of rack and pinion is precisely controlled. This critical fit is not left to chance as in other makes of Indicators. Unit movement is positioned for optimum mesh, then locked securely.
9. Rack and pinion mesh is maintained by rugged, precise pin and slide. Spindle can't shift rotationally.
10. Pull back spring maintains positive contact pressure, never wears out.
11. Low-friction, bronze bushing is custom fitted to the spindle so you can be sure of the best possible operation.

DIAL INDICATOR



What is MIRACLE MOVEMENT???

. . . . it is an Indicator mechanism
so wear resistant
so shock resistant
you will probably never
have to repair or replace it.

The MIRACLE MOVEMENT is so called because it possesses a durability far in excess of what is normally expected in a Dial Indicator mechanism. The rack spindle, as well as all gears and pinions, are tough hardened by a special process. This process, unlike other means of hardening, does not — in any way — alter tooth form or geometry of the part, thus making it economically feasible to provide lasting protection for these parts against wear and shock. The MIRACLE MOVEMENT, by repeated tests, has been proven to outlast competitive Indicator mechanisms many times over.

A Regular Feature...

MIRACLE MOVEMENT is *not* an optional added cost feature. Quite the contrary, it has been incorporated into all Miniature, Regular, Perpendicular, Wetproof, Electricator and Long Range models. *And you pay nothing extra for it!* To get the tremendous advantage of Miracle Movement, you need only specify FEDERAL. All MIRACLE MOVEMENT Indicators show this symbol — MIRACLE MOVEMENT — on the dial.

Shock Protection at No Extra Cost...

The MIRACLE MOVEMENT *itself* is shock-proof. You need no extra, added-cost cushioning devices, as with other Indicators, to get lasting protection against shock. You get this added protection *without extra cost* and without having to specify it. Every MIRACLE MOVEMENT Indicator has it!

HOW TO ORDER

Select

✓ TYPE OF INDICATOR . . .

The Picture Index on page 1 shows at a glance the many types of Federal Dial Indicators available and where to find them. Check the specialized types as well as regular AGD models.

✓ MODEL . . .

The Dial of each Indicator is shown FULL SCALE so you can choose the model best suited to the magnification, range and viewing needs of your job. See page 39 for details of selection.

UNLESS OTHERWISE DESCRIBED

Each Federal Dial Indicator is furnished with . . . and its price includes . . . a low friction, Full Jeweled Movement, a Balanced Dial (plus on right), a vertical (centered) lug Back and a 3/16" radiused steel point, 1/4" long.

✓ ACCESSORIES . . .

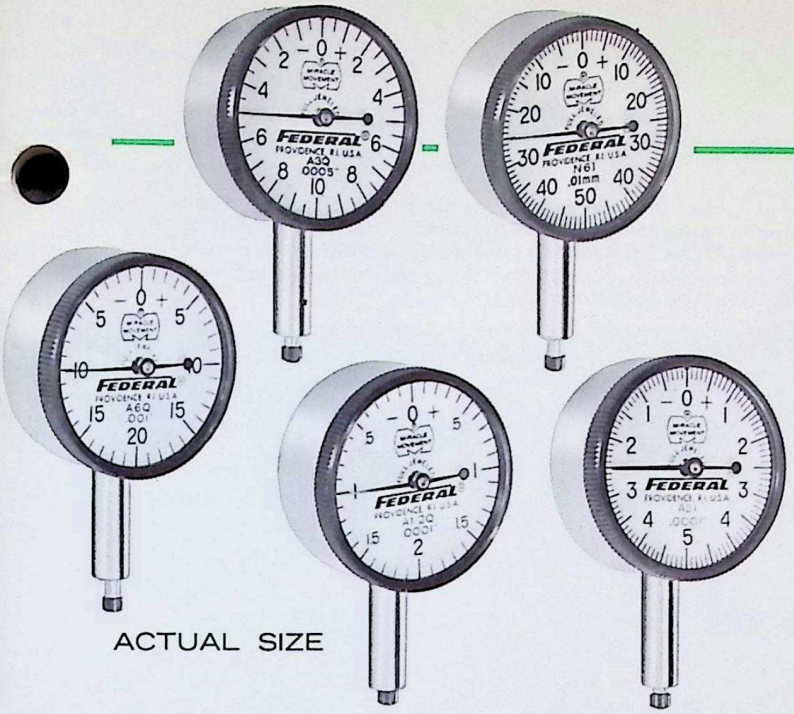
These are important because they can greatly increase the speed, efficiency and convenience of obtaining desired results. Pages 18 and 19 show a wide selection available at small additional cost.

✓ OPTIONALS . . .

You are not restricted to the normally furnished equipment mentioned above. A wide choice of optionally available Points, Backs, Dial arrangements, etc. can be specified at little or no extra cost

A.G.D. SPECIFICATIONS

Certain specifications for regular type Dial Indicators have been standardized by the American Gage Design Committee, made up of leading Indicator Manufacturers and users. These standards representing minimum requirements (referred to as A.G.D. and symbolized by the mark AD) were established in the interests of uniformity, accuracy and interchangeability. All regular type Federal Indicators are made to these specifications. In addition to specifying certain Indicator dimensions A.G.D. requires that Indicator range be determined by 2½ revolutions of the hand, starting from the 9 o'clock (rest) position. It also specified that readings of an Indicator shall repeat within ⅛ of a dial division and that calibration error be no greater than one dial division in 2⅓ revolutions of the hand, starting at the 10 o'clock position. For a full explanation of A.G.D. specifications, ask your nearest Federal office for Bulletin (Emergency) CS (E) 119-45.



ACTUAL SIZE

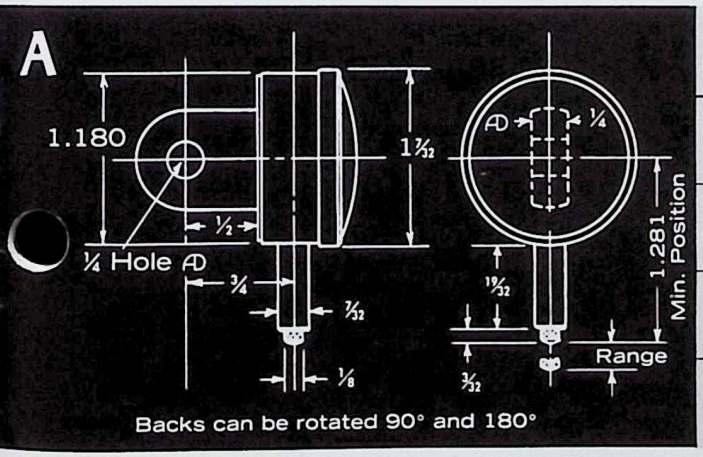
MINIATURE

A SIZE

MIRACLE MOVEMENT / SHOCKPROOF

Federal Miniatures are designed for use in areas where space is at a premium. They offer, in compact form, a good balance of Indicator qualities. They are accurate, sensitive and have the strength and durability necessary for long service. Like the regular AGD Models, they have low friction, full-jeweled Miracle Movements and adjustable bezels for quick, accurate zero setting. They are normally furnished with balanced dials (plus on right). Continuous (clockwise) dials are optional at no extra cost.

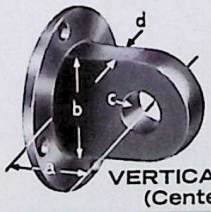
TRACING TEMPLATES AVAILABLE ON REQUEST



Backs can be rotated 90° and 180°

	ENGLISH *Values in Inches*				METRIC (mm)
VALUE OF EACH GRAD.	.0001	.0001	.0005	.001	.010
RANGE PER REVOLUTION	.004	.010	.020	.040	1.00
TOTAL RANGE	.010	.025	.050	.100	2.50
MODEL	A½Q	A2 I	A3Q	A6Q	N6 I

BACKS — Vertical (Centered) Lug Back is normally furnished and included in price of Indicator

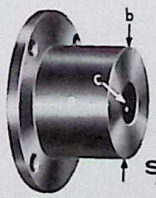


VERTICAL LUG (Centered)

a	b	c	d
½	11/16	¼	¼

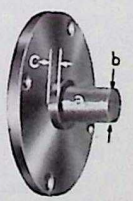
ADJUST.

a	b	c	d	e
⅛	⅜	8-32	¼	11/16



SCREW TYPE

a	b	c
½	11/16	¼-28



POST

a	b	c
5/16	7/32	1/16

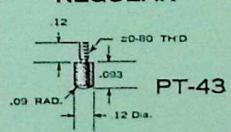
FLAT

SPLIT BUSHING, BU-112 — Fits stem, has .375" O.D., steel, .50" long

POINTS *(A size only)*

Regular Point is normally furnished and included in price of Indicator. Other types are stocked and can be furnished at slight additional cost.

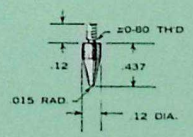
REGULAR



PT-43

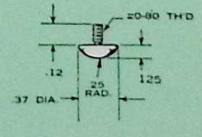
Stocked in other lengths, every eighth inch from ¼" to 1".

TAPER



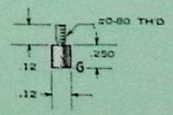
PT-119

BUTTON

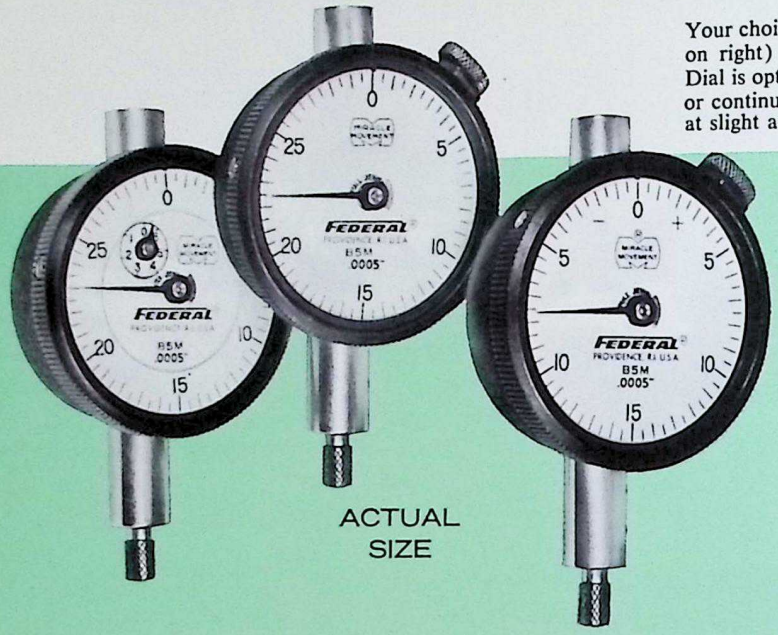


PT-118

FLAT



AL-61



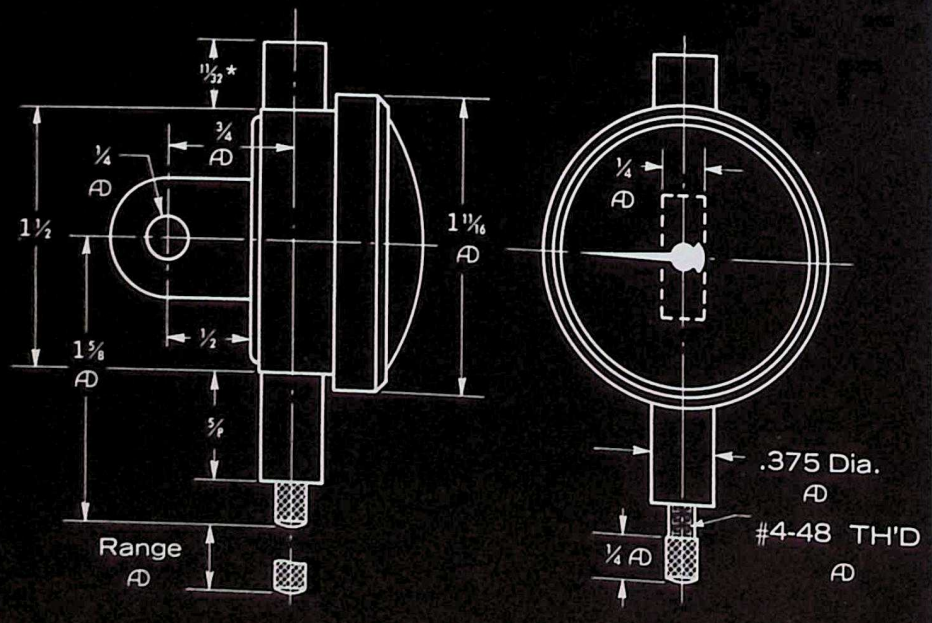
Your choice of three basic dials. Balanced Dial (with plus on right) is normally furnished. Continuous, clockwise Dial is optional at no additional cost. Ring Dial (balanced or continuous) with Revolution counter can be furnished at slight additional cost.

VALUE OF EACH GRADUATION	RANGE PER REVOLUTION	TOTAL AGD RANGE	MODEL

Numbered graduations indicate thousandths of an inch.

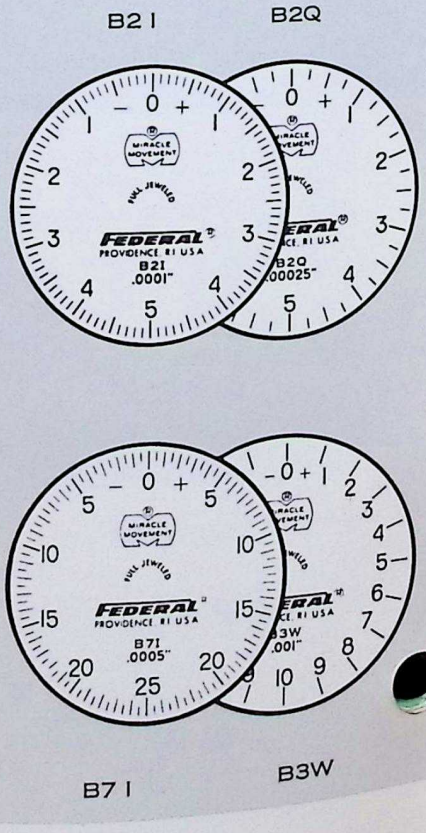
TRACING TEMPLATES AVAILABLE ON REQUEST

B



*except 7/16 for B8 I

B size backs can be rotated 180°



B SIZE · AGD GROUP 1

MIRACLE MOVEMENT / SHOCKPROOF

ENGLISH *Values in Inches*										METRIC *Values in mm*
	.0001	.00025		.0005				.001			.010
	.010	.010	.020	.020	.030	.040	.050	.020	.050	.100	1.00
	.025	.025	.050	.050	.075	.100	.125	.050	.125	.250	2.50
	B2 I	B2Q	B3K	B3Q	B5M	B6K	B7 I	B3W	B7O	B8 I	O6 I

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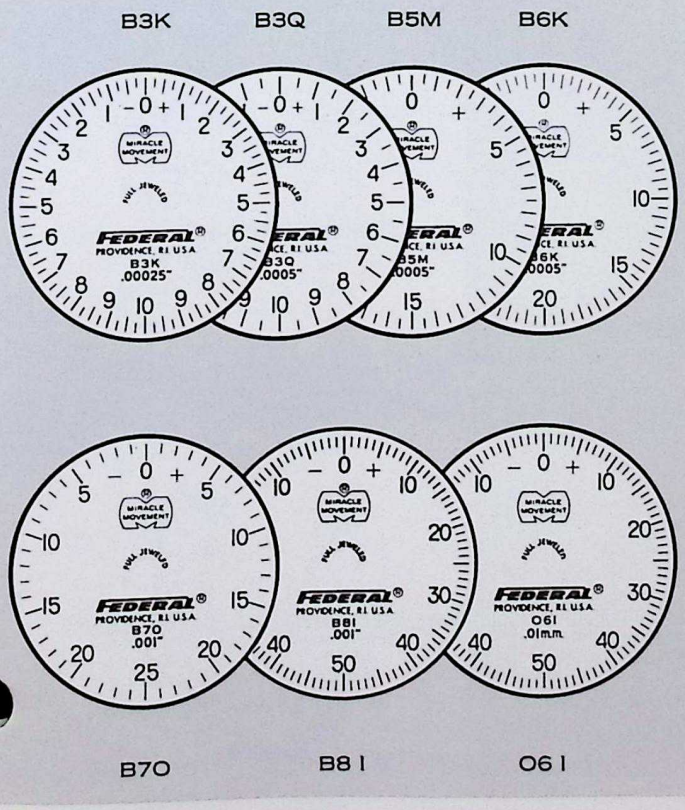
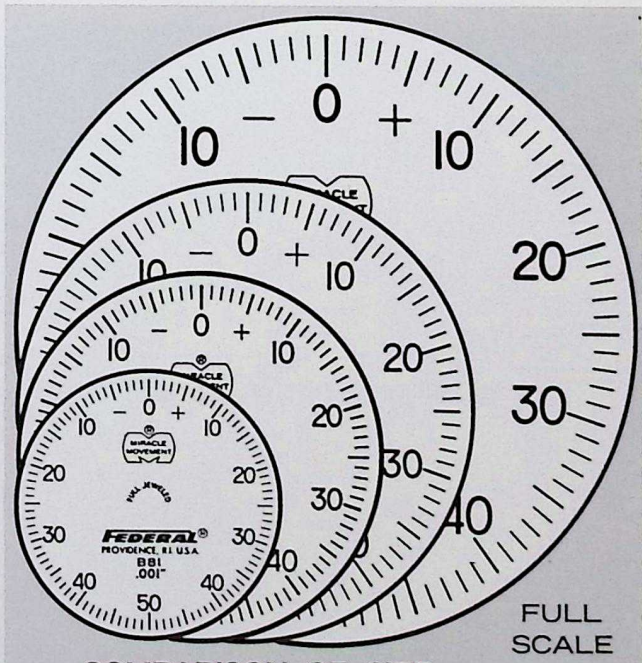




FULL SCALE

COMPARISON OF SIZE

The four groups of AGD type Indicators are represented by the dials shown full scale above, permitting a convenient comparison when selecting Indicator size.

ACTUAL SIZE

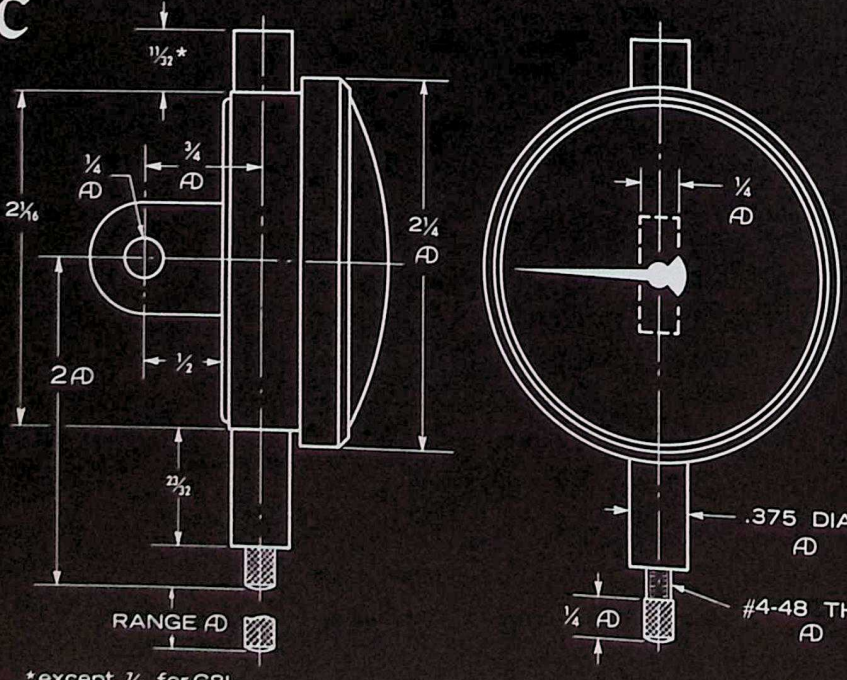
Your choice of three basic dials. Balanced Dial (with plus on right) is normally furnished. Continuous, clockwise Dial is optional at no additional cost. Ring Dial (balanced or continuous) with Revolution counter can be furnished at slight additional cost.

Numbered graduations indicate thousandths of an inch.

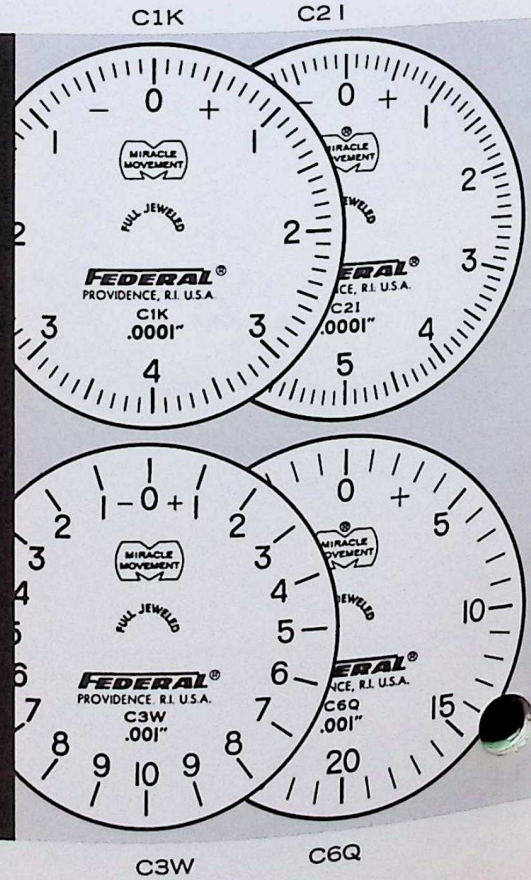
VALUE OF EACH GRADUATION
RANGE PER REVOLUTION
TOTAL AGD RANGE
MODEL

TRACING TEMPLATES AVAILABLE ON REQUEST

C



*except 1/16 for C8I



C SIZE · AGD GROUP 2

MIRACLE MOVEMENT / SHOCKPROOF

	ENGLISH *Values in Inches*								METRIC *Values in mm*						
	.0001		.00025		.0005				.001				.002	.005	.010
	.008	.010	.010	.020	.020	.030	.040	.050	.020	.040	.050	.100	.200	.500	1.00
	.020	**.025**	**.025**	**.050**	**.050**	**.075**	**.100**	**.125**	**.050**	**.100**	**.125**	**.250**	**.500**	**1.25**	**2.50**
	C1K	C2 I	C2Q	C3K	C3Q	C5M	C6K	C7 I	C3W	C6Q	C70	C8 I	P1 I	P3 I	P6 I

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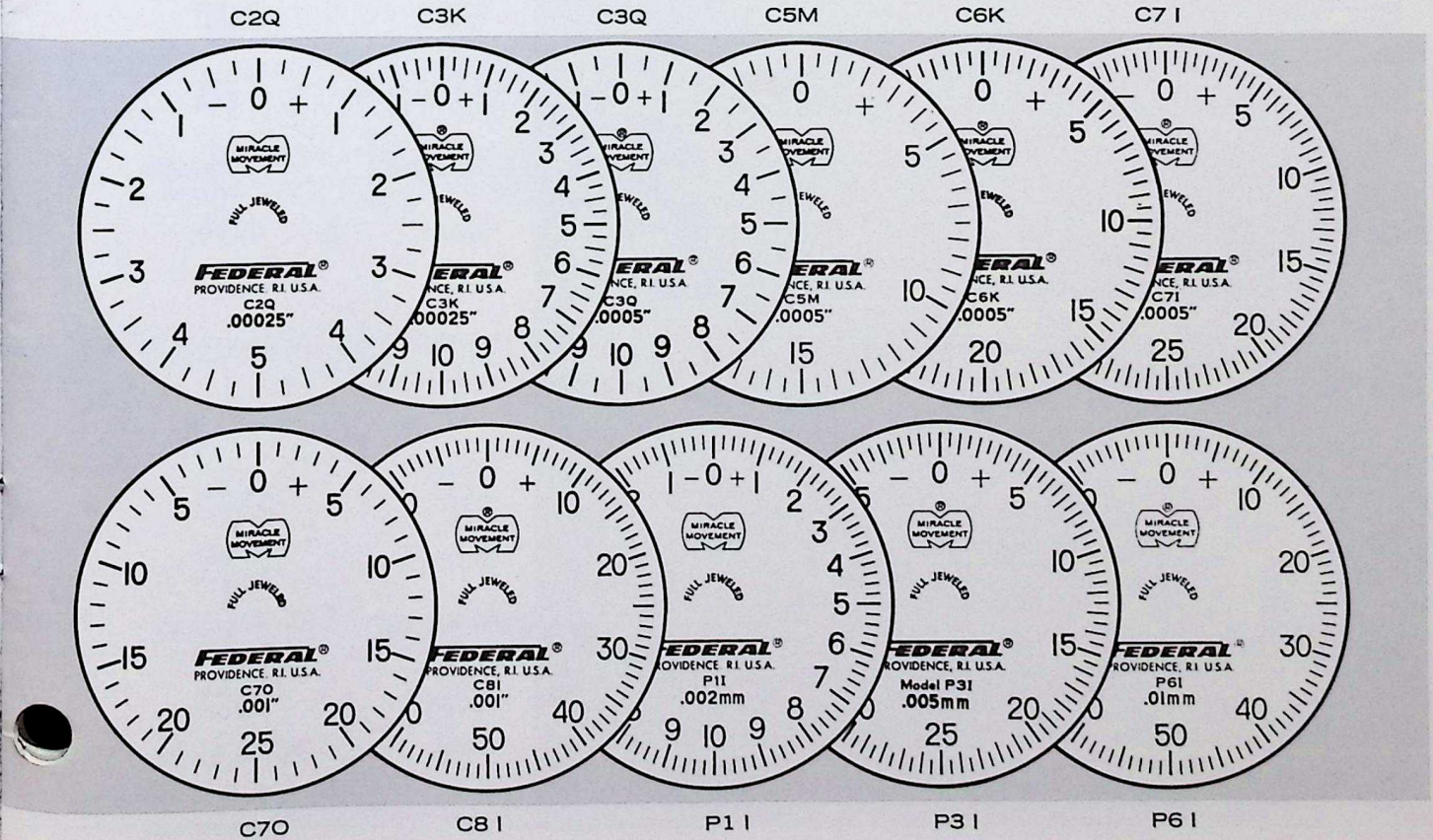
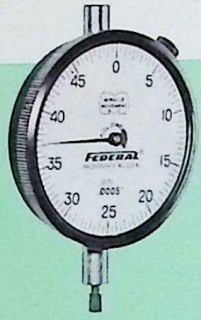
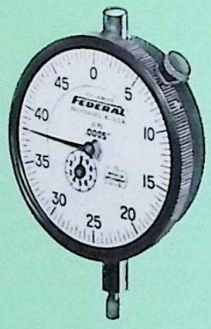
Models with .00005″ graduations . . . page 26



ACTUAL SIZE





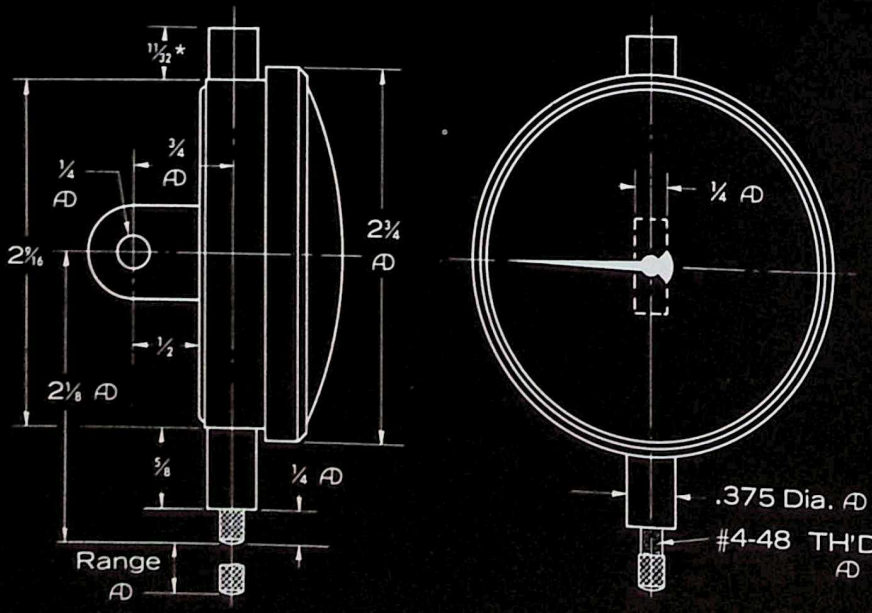
Numbered graduations indicate thousandths of an inch.

Your choice of three basic dials. Balanced Dial (with plus on right) is normally furnished. Continuous, clockwise Dial is optional at no additional cost. Ring Dial (balanced or continuous) with Revolution Counter can be furnished at slight additional cost.

VALUE OF EACH GRADUATION
RANGE PER REVOLUTION
TOTAL AGD RANGE
MODEL

TRACING TEMPLATES AVAILABLE ON REQUEST

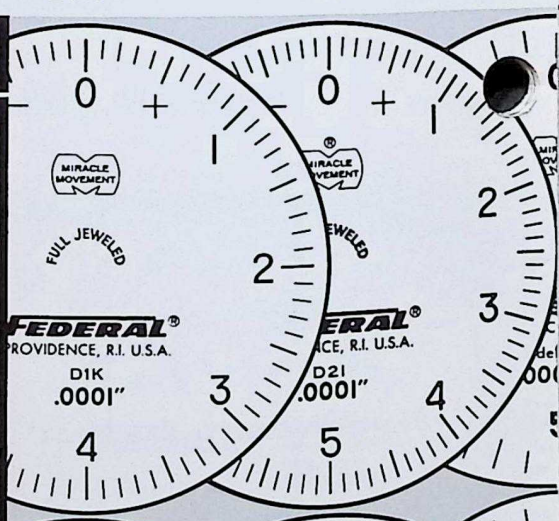
D

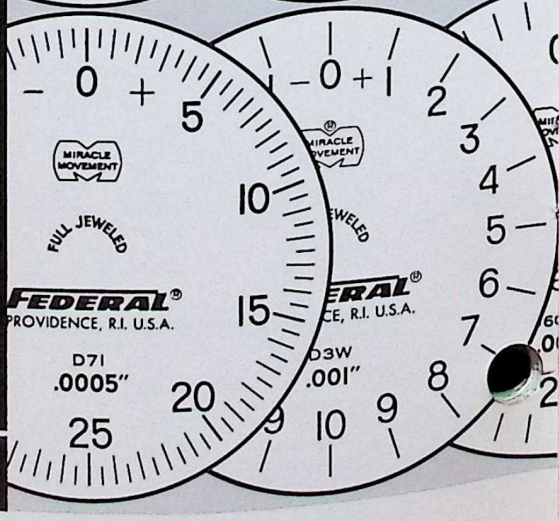


*except 1/16 for D8 I

D1K

D2 I





D7 I

D3W

D SIZE · AGD GROUP 3

MIRACLE MOVEMENT / SHOCKPROOF

ENGLISH Values in Inches														METRIC Values in mm		
	.0001		.00025			.0005				.001				.002	.005	.010
	.008	.010	.010	.020	.030	.020	.030	.040	.050	.020	.040	.050	.100	.200	.500	1.00
	.020	.025	.025	.050	.075	.050	.075	.100	.125	.050	.100	.125	.250	.500	1.25	2.50
	D1K	D2 I	D2Q	D3K	D5G	D3Q	D5M	D6K	D7 I	D3W	D6Q	D7O	D8 I	Q1 I	Q3 I	Q6 I

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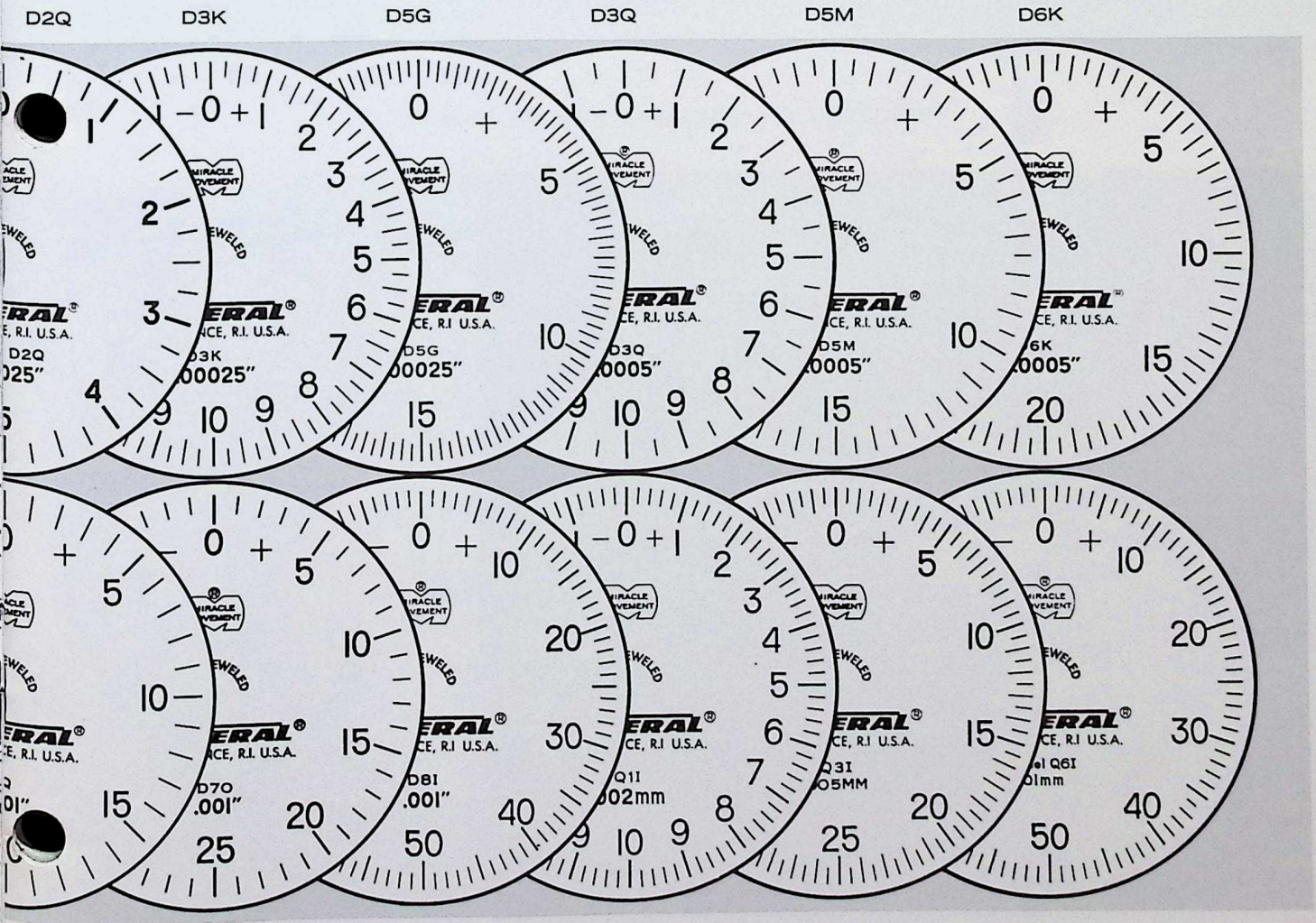


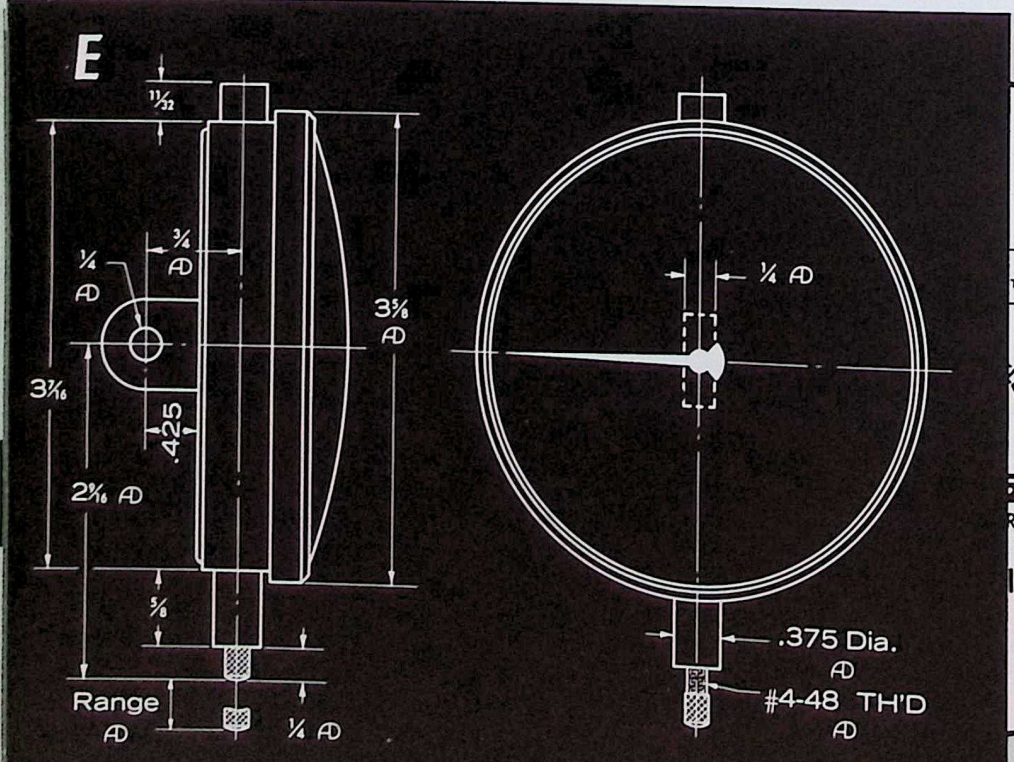
Your choice of three basic dials. Balanced Dial (with plus on right) is normally furnished. Continuous, clockwise Dial is optional at no additional cost. Ring Dial (balanced or continuous) with Revolution Counter can be furnished at slight additional cost.

MODEL E8 I
ACTUAL SIZE

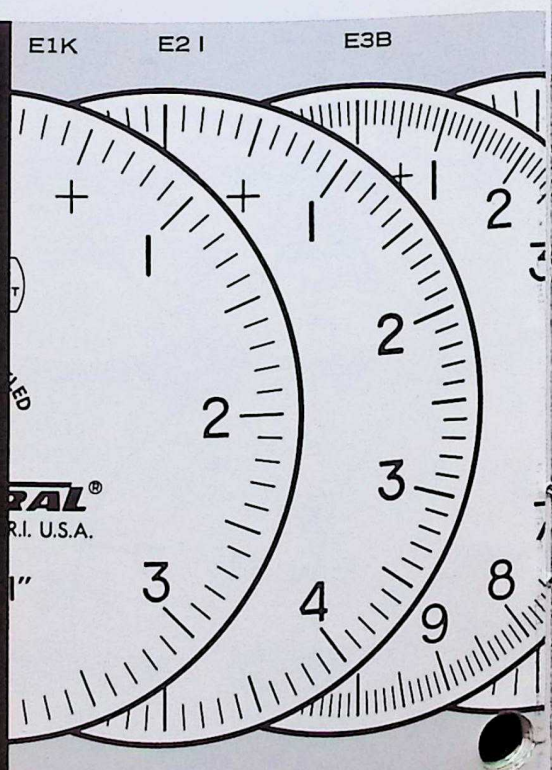
VALUE OF EACH GRADUATION	RANGE PER REVOLUTION	TOTAL AGD RANGE	MODEL
.001"	.100"	.500"	E8 I

Numbered graduations indicate thousandths of an inch.

TRACING TEMPLATES AVAILABLE ON REQUEST



E size backs can be rotated 90° and 180°



E SIZE · AGD GROUP 4

MIRACLE MOVEMENT / SHOCKPROOF

	ENGLISH *Values in Inches*											METRIC *Values in mm*	
	.0001			.00025		.0005			.001			.002	.010
	.008	.010	.020	.020	.030	.020	.030	.050	.020	.050	.100	.200	1.00
	.020	**.025**	**.050**	**.050**	**.075**	**.050**	**.075**	**.125**	**.050**	**.125**	**.250**	**.500**	**2.50**
	E1K	E2 I	E3B	E3K	E5G	E3Q	E5M	E7 I	E3W	E7O	E8 I	R1I	R6 I

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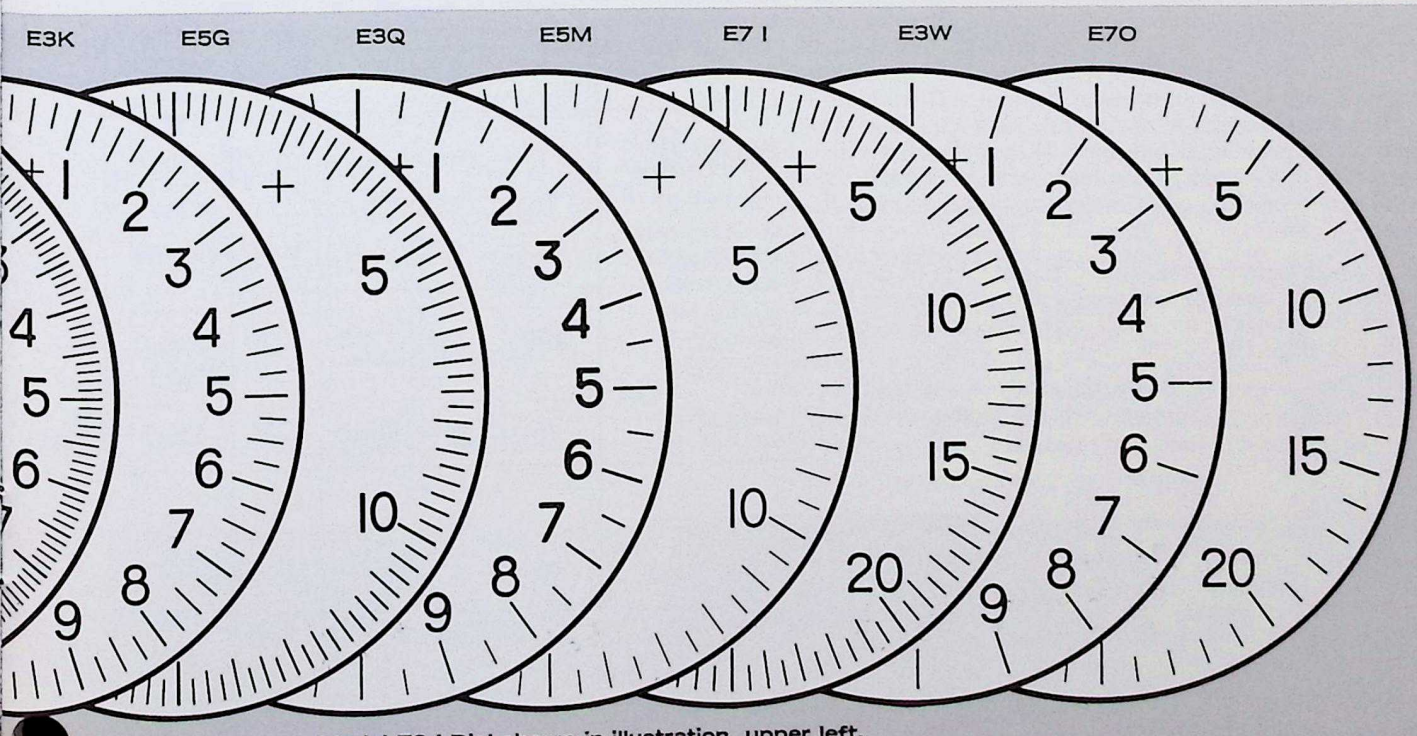
SPECIAL RANGES — page 20

Models with .000050″ graduations . . . page 26

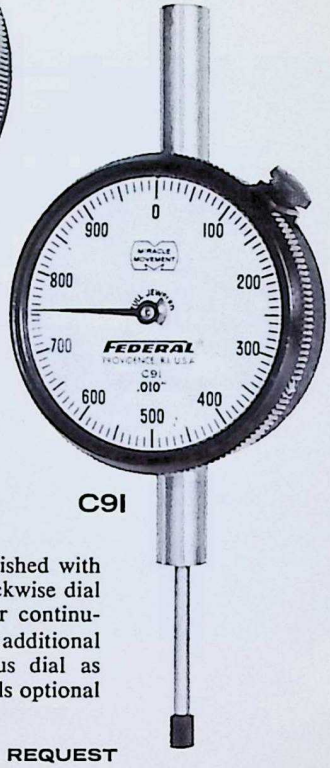


Model E8 I Dial shown in illustration, upper left.

For appearance of Metric Dials, see Models Q1 I and Q6 I, page 11.

LONG RANGE

MIRACLE MOVEMENT / SHOCKPROOF



All models (except C9I) are normally furnished with revolution counter and with continuous, clockwise dial as shown. Balanced dial (plus on right) or continuous, counterclockwise dial is optional at no additional cost. Model C9I furnished with continuous dial as shown but less revolution counter. Other dials optional at extra cost.

TRACING TEMPLATES AVAILABLE ON REQUEST

Federal Long Range Indicators measure up to the same exacting standards of dependability that have made the Regular type Indicators so popular. They are particularly suited to the measurement of slide travel, cam throw and other extended range measurements.

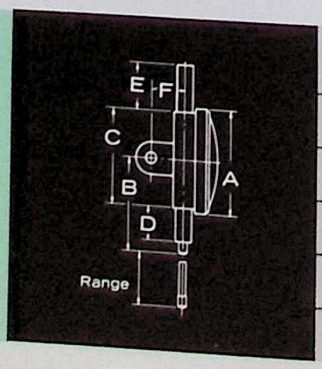
Long Range Indicators may be used with any of the Federal backs and contact points and most of the accessories available for AGD type Indicators (see page 16 through 19).

All long range models are Miracle Movement Indicators and are normally furnished with Full Jeweled bearings and vertical (centered) lug Back.

	ENGLISH *Values in Inches*				METRIC *(mm)*
VALUE OF EACH GRAD.	.001			.010	.010
RANGE PER REVOLUTION	.100			1.00	1.00
TOTAL RANGE	.500	1.00	1.00	1.00	25.0
MODEL	C8IQ	C8IS	D8IS	C9I	Q6IS*
A	2¼	2¼	2¾	2¼	2¾
B	2	2	2⅛	2	2⅛
C	2 1/16	2 1/16	2 9/16	2 1/16	2 9/16
D	23/32	23/32	⅝	23/32	⅝
E	¾	1 13/64	1 13/64	1 13/64	1 13/64
F	¾	¾	¾	¾	¾

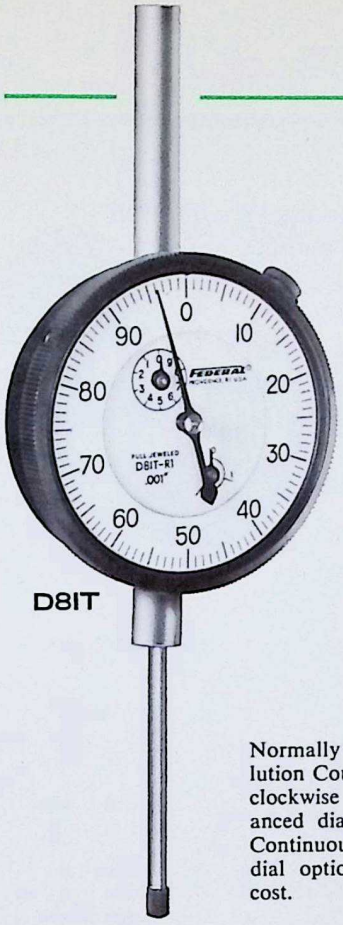
LOW MAGNIFICATION MODEL

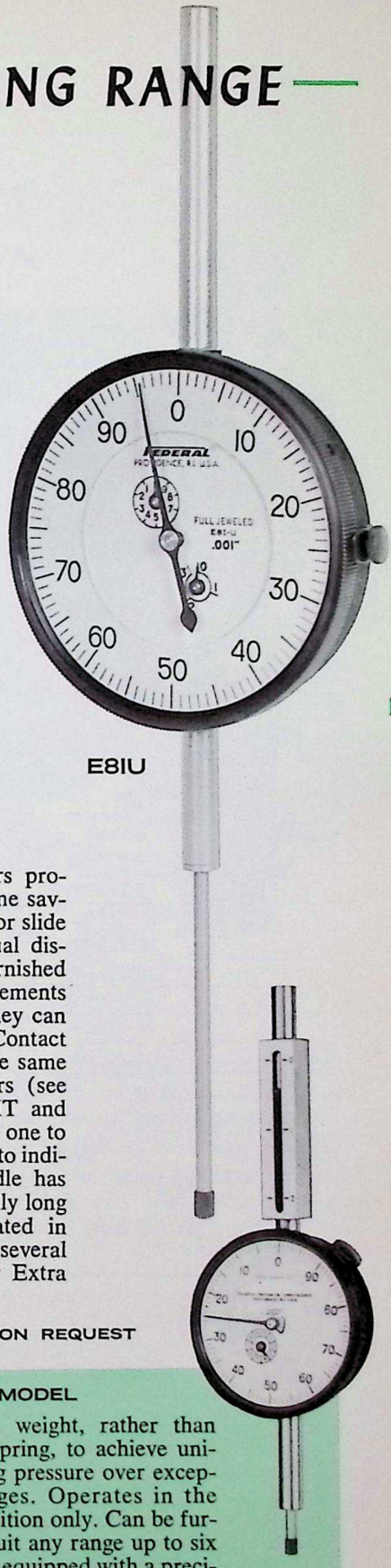
Model C9I has a total range of one inch, represented by one revolution of the hand. Its low magnification (approximately 6:1) enables it to take the place of a direct reading scale, providing more accurate, convenient readings. Furnished without Revolution counter.



*Dial same as Model Q6 I, page 11.

EXTRA LONG RANGE



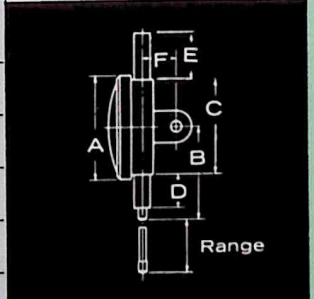


Normally furnished with Revolution Counter and Continuous, clockwise dial, as shown. Balanced dial (plus on right) or Continuous, counterclockwise dial optional at no additional cost.

Federal Extra-Long Range Indicators provide considerable convenience and time saving when positions must be indicated or slide travel must be measured over unusual distances. All Models are normally furnished with Full-Jeweled, Low-Friction movements and vertical (centered) lug Back. They can be equipped with the same Backs, Contact Points, Tolerance Hands; many of the same accessories as Regular type Indicators (see pages 16 through 19.) Models D8IT and E8IU are equipped with two counters, one to show number of revolutions, the other to indicate the number of inches the spindle has traveled. Model E3BS has exceptionally long range, considering that it is graduated in tenths of thousandths and provides several times the magnification of the other Extra Long Range Models.

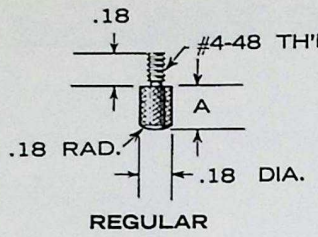
TRACING TEMPLATES AVAILABLE ON REQUEST

	ENGLISH (Values in Inches)		
VALUE OF EACH GRAD.	.0001	.001	
RANGE PER REVOLUTION	.020	.100	
TOTAL RANGE	.400	2.00	3.00
MODEL	E3BS	D8IT	E8IU
A	3⅜	2¾	3⅜
B	2⁹⁄₁₆	2⅛	3⅛
C	3⅛	2⁹⁄₁₆	3⅛
D	⅝	⅝	1½
E	¹³⁄₃₂	2⅛	3⅛
F	¾	¾	¾



SPECIAL MODEL

Employs a weight, rather than pull-back spring, to achieve uniform gaging pressure over exceptional ranges. Operates in the vertical position only. Can be furnished to suit any range up to six inches, and equipped with a precision weight to suit the gaging pressure desired.



REGULAR

POINTS

Federal Contact Points are hardened steel unless otherwise specified and are blackened to retard rusting. The tip of each point is polished to prevent scratching workpiece.

¼" length furnished unless otherwise specified.

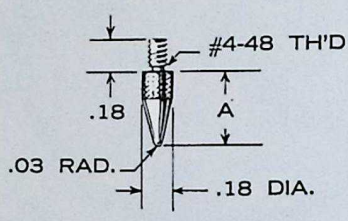
DIM. A	PART NO.
⅛	PT-225
¼	PT-223
⅜	PT-563
½	PT-14
⅝	PT-564
¾	PT-31
⅞	PT-201
1	PT-232
1⅛	PT-305
1¼	PT-565
1⅜	PT-239
1½	PT-50
1⅝	PT-235
1¾	PT-241
1⅞	PT-100
2	PT-51
2⅛	PT-243
2¼	PT-696
2⅜	PT-101
2½	PT-245
2⅝	PT-102
2¾	PT-566
2⅞	PT-247
3	PT-155

PT-223 also available with T. Carbide face, specify PT-35 and with diamond tip, specify PT-317

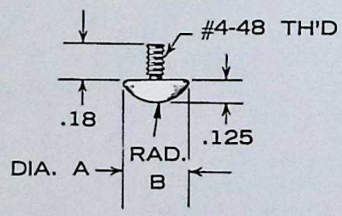
Sizes ⅛" thru 1" available in set, specify PT-116

Sizes ⅛" thru 3" available in set, specify PT-115

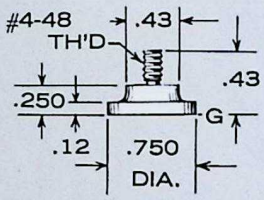
TAPERED



BUTTON

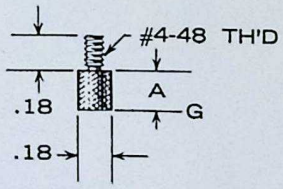


EXTRA WIDE FACE

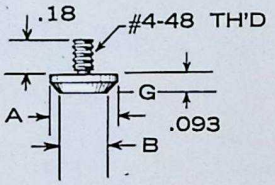


AL-291

FLAT END



WIDE FACE



TAPERED

DIM. A	PART NO.
3⁄16	PT-233
7⁄16	PT-229
1	PT-253
1 7⁄16	PT-230
2	PT-231
Tungsten Carbide Tip	
7⁄16	PT-181
¾	PT-182
1	PT-183

BUTTON

DIA. A	RAD. B	PART NO.
.375	.250	PT-227
.500	.375	PT-619
.375	.250	PT-120*

*Has Tungsten Carbide face

FLAT END

DIM. A	PART NO.
⅛	AL-19
¼	AL-673*
⅜	AL-20
½	AL-21
⅝	AL-22
¾	AL-23
⅞	AL-24
1	AL-25

Sizes ⅛" thru 1" available in set. Specify AL-55.

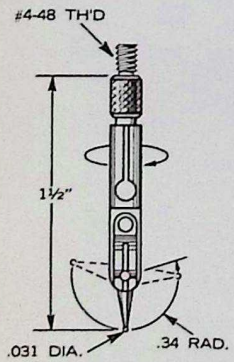
For T.C. flat, specify AL-51.

WIDE FACE

DIA. A	DIA. B	PART NO.
.356	.250	AL-502*
.500	.375	AL-1510
.615	.500	AL-520
.731	.625	AL-44

For T.C. flat, specify AL-1730

UNIVERSAL



PT-2197

Rachet mounted tip allows choice of 20 positions in arc of 220°. Choice of T.C. or hard chrome steel.

Tip adjusts radially anywhere in 360°. Split collar hugs back tapered shank for snug, dependable fit.

Can use tip from any Testmaster, except Long Contact models (see page 33).

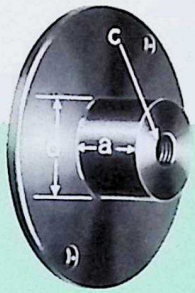
Many Other Points Available...

In addition to the more commonly required points shown here, Federal stocks an almost endless variety of shapes and sizes to suit special needs and can meet most any requirement without delay. Where subject to excessive wear, points can be furnished tipped with diamond, tungsten carbide or hard chromed plated. Diamond and tungsten carbide points are gold plated for identification.

BACKS

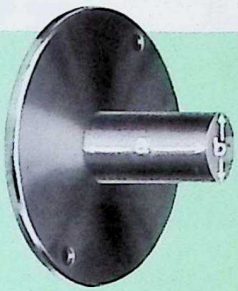
for AGD, Long Range and Extra Long Range Models

Note: B size backs can be repositioned 180°; E size backs 90° and 180°.



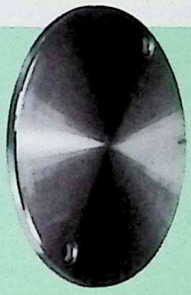
SCREW TYPE

a = ½" b = 11/16"
c = ¼"-28

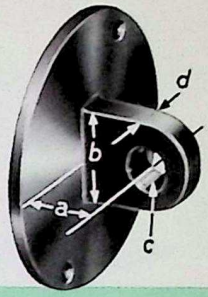


POST

a = 1"
b = ½"



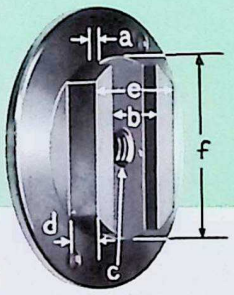
FLAT



VERTICAL LUG
(Centered)
NORMALLY FURNISHED
Included in price of Indic.

a* = ½" b = 11/16"
c = ¼" d = ¼"
*a = 27/64" for E Size

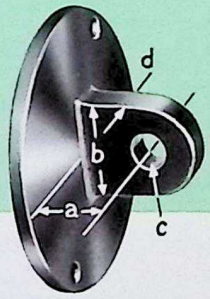
HORIZONTAL LUG
(Centered)
Dimensions same as above



ADJUSTABLE

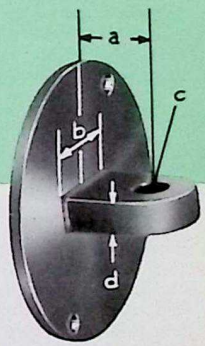
a = ⅛" b = ½"
c = ¼"-20 d = ¼"
e = ⅜" f* = 1¼"

*f = ⅞" for B Size and has no flats.



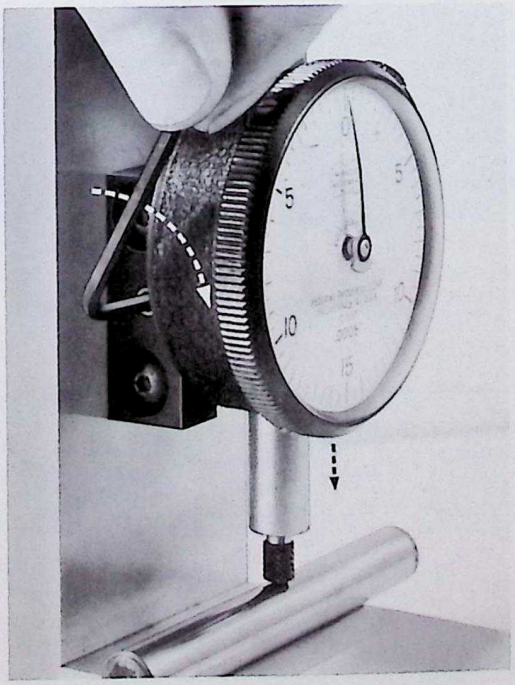
VERTICAL LUG
(Offset)
Left face is centered

a* = ½" b = 11/16"
c = ¼" d = ¼"
*a = 27/64" for E size

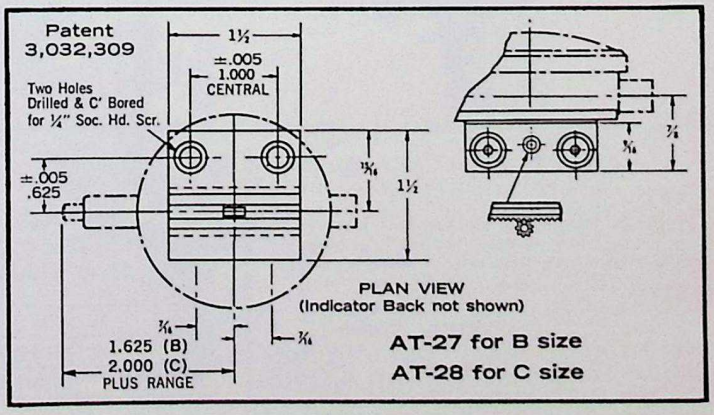


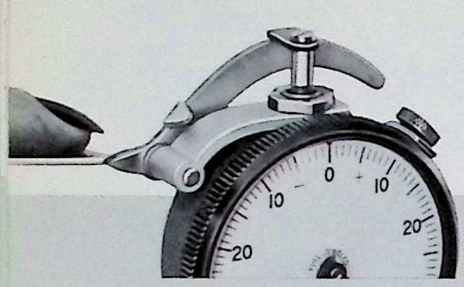
Many special design backs also available to suit special requirements.

ADJUSTABLE MOUNTING BRACKETS

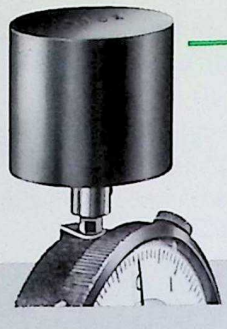


These patented brackets permit closely controlled positioning of the Indicator over a wide range. A dovetail slide on the Indicator back fits a mating dovetail in the bracket. Position is adjusted by rack and pinion. AT-27 for B size Indicators has ⅞" range. AT-28 for C size has 1 1/16" range. Final position is secured by a double lock with practically no shift in Indicator position. The same bracket fits either size dovetail Back which is included in price of bracket.

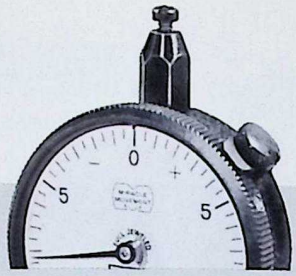




For AGD and Long Range Models only.



For AGD, Long Range and Extra Long Range Models



For AGD Models

CAM TYPE LIFTING LEVERS

Attaches easily, operates smoothly, greatly speeds up many measurements. Designed so that added pressure cannot be applied to spindle by operating in reverse. No special back required. Base of lever threads onto bushing which normally receives dust cap, secures with flat nut. Furnished with lever at left, as shown, unless otherwise specified. Available also with lever at right.

WEIGHTS

Permit proper and precise measurement of compressible materials such as rubber, textiles etc. Applies constant pressure throughout range of Indicator. Can be furnished in place of pull-back spring in accordance with technical society standards (TAPPI, ASTM, etc.) Exerts constant pressure directly to rack spindle, not through Indicator movement. Specify requirement.

RANGE LIMITING CAP, CS-123

Attaches quickly in place of regular dust cap. Can be adjusted over a range of approximately ⅜" to limit Indicator range to any desired amount.

Permits inexperienced operators to measure dependably by eliminating any chance of full revolution error. Does not prevent Indicator from being used with stem mounted devices.

RIGHT ANGLE ATTACHMENTS

To provide transfer of motion at right angles to Indicator spindle. Regular Model A-9 has flat spring hinge and operates over range of .120". Long Range Model AT-24 has pivot type bearing and operates over range of .375". Certain applications may require a contact point longer than ¼" when using B, D, and E size Indicators. Should be used with Indicator having a radiused contact point.

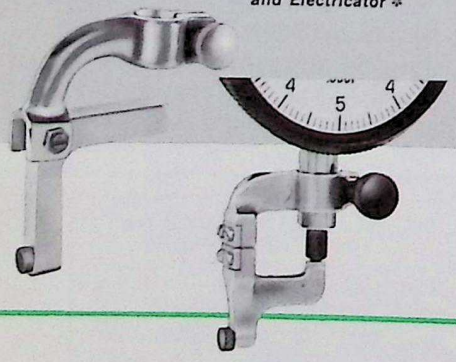
AUXILIARY PLUNGERS

Available in two lengths. Can be quickly attached to Indicator to act as precision transfer unit, protecting spindle bushing from side thrust and severe contact wear. Permits Indicator to be stem mounted without binding spindle and provides pretravel for Indicator having less than .250" range. Attaches by split collet. Contact is hardened steel. Does not permit use of lifting lever.

HOLE ATTACHMENTS

Available in two lengths. Provide a very convenient means of checking internal surfaces and other points which are normally inaccessible to regular Indicators. Both Models are extremely rigid and have adjustable pivot bearing with lock nut. Should be used with Indicator having a radiused contact. Can also be furnished to fit Indicators, such as Perpendicular Model F8 I with .275" dia. stem.

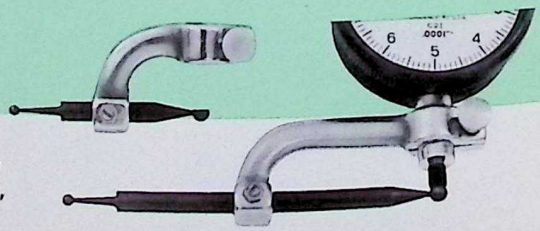
For AGD, Perpendicular and Electricator ✲



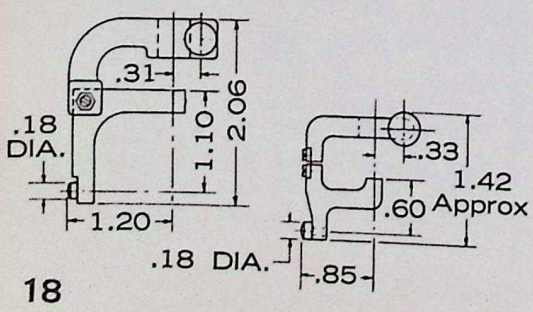
For AGD, Perpendicular and Electricator Models ✲

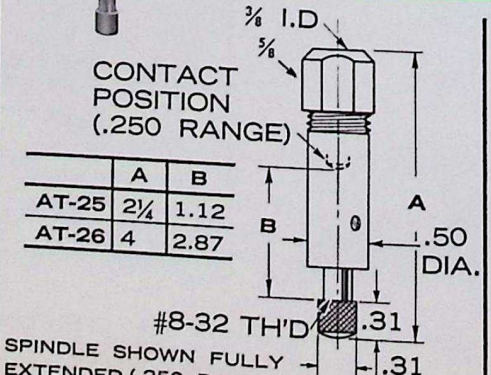
TWO SIZES

For AGD, Perpendicular and Electricator Models ✲



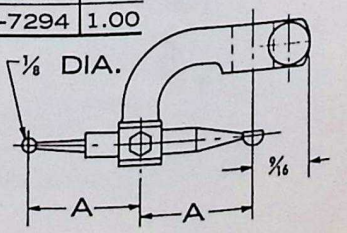
✲Can also be used with Model C½K, page 27.





	A	B
AT-25	2¼	1.12
AT-26	4	2.87

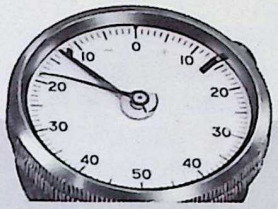
	A
AT-7293	1.87
AT-7294	1.00



Models available also to fit .275" stem

ACCESSORIES

For AGD, Long Range, Extra Long Range and some Perpendiculars



For AGD Models (B, C, D, & E size, .001" Grads, plain dials)

For AGD and Long Range Models (C size only).

TOLERANCE HANDS

Can be set independently of each other anywhere on dial by rotating split bezel which locks in place by means of bezel clamp. Hands do not interfere with setting of dial position and are colored red to provide easily observable limits for any dimension. Do not obscure dial or hinder quick reading. Furnished integrally with split bezel which is easy to attach in place of regular bezel.

MAGNETIC MAXIMUM HAND

Attaches by means of magnetic clutch beneath Indicating Hand so view of Dial is unobstructed. Accurately indicates maximum reading and is easily reset by finger attached to front half of split bezel. Does not affect setting the position of the dial, accomplished by turning back half of split bezel. Operation limited to one revolution of hand.

PROTECTIVE HOUSINGS

Made of tough, resilient plastic, provides real protection against shock. Open at rear so Indicator can be mounted by back. Mounts to Indicator stem by means of split bushing BU-111. Also fits split Collet AD-87 (bottom of page) and Auxiliary Plungers AT-25 and AT-26 (opposite page). Specify HG-100 for AGD Indicators; HG-101 for Indicators having greater ranges up to one inch.

SPLIT BUSHING, BU-80

Made of cold rolled steel and blackened to retard rusting. Fits precisely on any .375" diameter stem, permits Indicator to be stem mounted without danger of binding spindle because it is internally relieved. Bushing is ½" long, .500" O.D. Relieved portion is .300" long, easily clears area of Indicator stem bushing when properly mounted with relief toward contact.

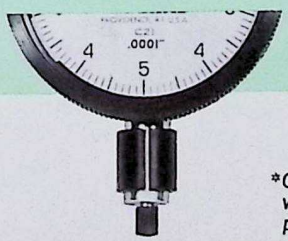
THREADED BUSHING, AD-62

AGD Indicators are stocked with threaded stems which can be supplied at no extra cost to permit use of threaded bushing for stem mounting of Indicator without danger of cramping spindle. Thread is $^{5}/_{16}$"-32; O.D. is .500". Bushing fits securely, is made of hardened steel and blackened to retard rusting. Threaded bushings for Perpendicular Indicators — page 23.

DUST GUARD, GU-2

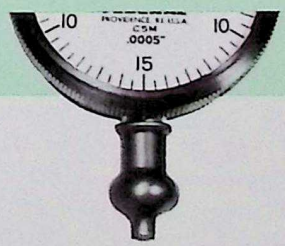
Provides protection for Indicator spindle and bushing when dust, talc or other contaminant is encountered but conditions are not severe enough to warrant use of Wetproof (sealed) type of Indicator. Guard is completely pliable and oil resistant. Does not affect accuracy or sensitivity of Indicator. Recommended for use with Models having .300" range or less.

*For AGD and Perpendicular Models**

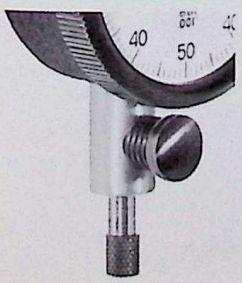


*For AGD Models**

*For AGD and Perpendicular Models**



**Can also be used with Model C½K, page 27.*

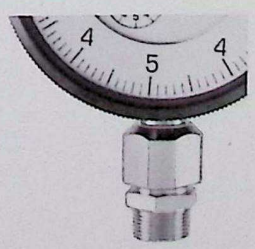


BRAKE ATTACHMENT AT-A-7

Recommended for B, C, D and E size Models, .001" grads.

Internally mounted, applies slight pressure to Indicator spindle to indicate minimum or maximum reading. Has release button on stem. No range limitation.

Similar device, AT-81, (not shown) is mounted in special Dust Cap. Range limited to .250" on "B" size models, .500" on "C" size.

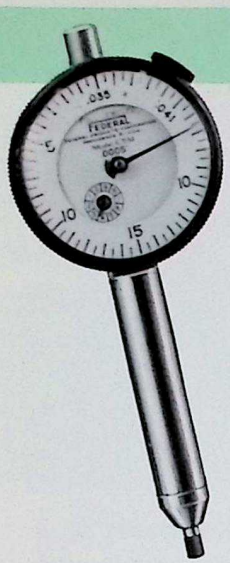


SPLIT COLLET, AD-87

For all Models having .375" dia. stem.

Permits easy, secure adjustment of Indicator position vertically or rotationally in any ½"-32 threaded hole. Grips Indicator stem uniformly by means of six fingers which are locked by nut having flats for $^{5}/_{8}$" wrench. Sized to fit in Protective Housing shown at top of page. Nickel plated. ½"-32 taps are also available from stock.

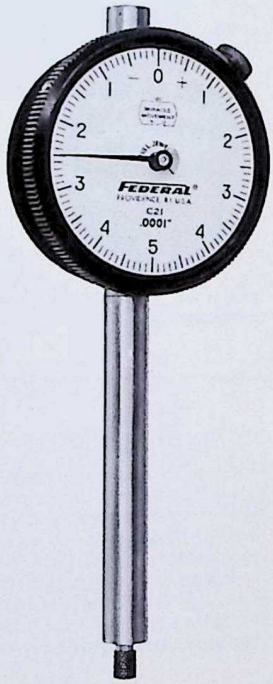
Special DESIGNS



Although Federal offers the widest choice of Dial Indicators, Test Indicators and associated equipment available, there is sometimes need for special design. Let Federal's experience, capability and unusually large stock of special items help you.

As described on these pages, there are many ways in which Federal can quickly meet the special needs which are most often encountered.

Though your requirement may be very special, chances are that Federal already has a design on file that will do the job, thus saving you the time and expense of a special design.



SPECIAL STEM LENGTHS

A long stem Indicator is often the economical answer to the problem of reaching deeply recessed or otherwise inaccessible surfaces. To meet this need, Federal stocks Indicator cases having stem lengths of 1½, 2, 3, 4, 5 and 6 inches so that any AGD Indicator can be supplied quickly at only slight additional cost. Stems of other lengths and diameters other than .375″ can be furnished also for many types of Indicators, prices on application.

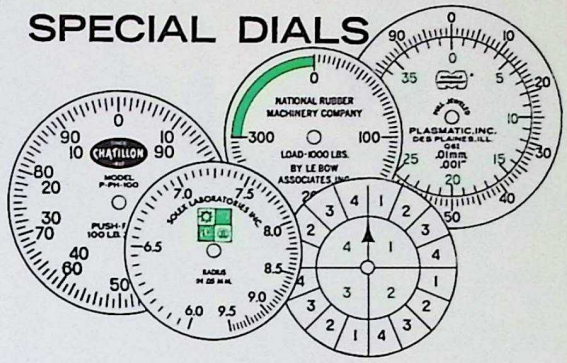
SPECIAL RANGES

To meet the frequent need for a special range, Federal offers an exceptionally wide choice, as shown in the table. Parts are stocked so that needs can be met quickly and at small additional cost. When the Indicator is to have greater than its normal (AGD) range, Revolution Counters are recommended. Special ranges other than shown can also be furnished. Send requirements for quote.

RANGE (Inches)	B2 I B2Q	B3K B3Q B3W	B5M	B6K	B7 I B7O	B8 I	C1K	C2 I C2Q	C3K C3Q C3W	C5M
.020							●	○	○	○
.025	●	○	○	○	○	○	○	●	○	○
.050	○	●	○	○	○	○	○	○	●	○
.075		○	●	○	○	○	○	○	○	●
.100			○	●	○	○	○	○	○	○
.125			○	○	●	○	○	○	○	○
.150						○		○	○	○
.200						○		○	○	○
.250						●			○	○
.300									○	○
.312										○
.375										○
.400										○

● Denotes AGD Range

SPECIAL DIALS



In addition to the wide choice of stocked dials offered for various Indicators, Federal can supply you with special markings at very little additional cost. Dials can be imprinted with your own firm name or trademark to discourage theft. Colored segments can be substituted for graduations to speed up sorting of work. Dials can be marked with special graduations having other than dimensional values and spaced to suit any linear or non-linear requirement. Send print for quote.

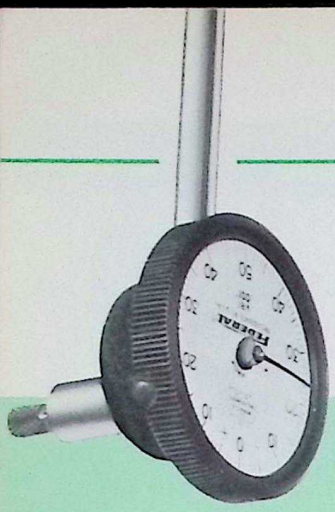
SPECIAL RATIOS

Gage design can sometimes be simplified by using Indicators having special gear ratios. Federal offers you a wide choice, providing unusual magnifications to suit various lever ratios, to present chordal measurements in terms of diameter etc. Whenever such designs are furnished, they will be identified by the words "SPECIAL RATIO" placed on the dial.

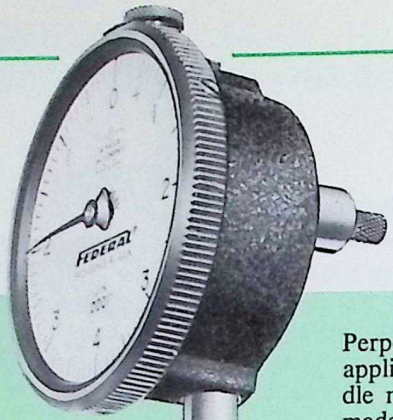
SPECIAL PROTECTION

Indicators often need special protection to perform properly in special environments and Federal has had considerable experience in providing it. For instance, Federal engineers know exactly how to equip Indicators for operation at temperatures far above or below those normally encountered. As a result of special studies, they know when you will require unpainted or etched dials, glass rather than plastic crystals, plated rather than painted cases etc., and so can equip your Indicator for operation at temperatures from approximately −40°F to +600°F.

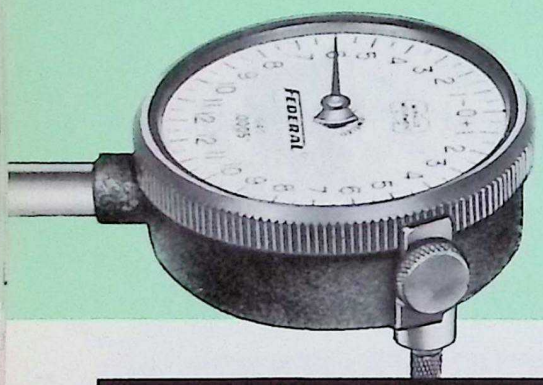
C6K C6Q	C7 I C7O	C8 I	D1K	D2 I D2Q	D3K D3Q D3W	D5G D5M	D6K D6Q	D7 I D7O	D8 I	E1K	E2 I	E3B E3K	E3Q E3W	E5G E5M	E7 I E7O	E8 I	RANGE (Inches)
○	○	○	●	○	○	○	○	○	○	●	○	○	○	○	○	○	.020
○	○	○	○	●	○	○	○	○	○	○	●	○	○	○	○	○	.025
○	○	○	○	○	●	○	○	○	○	○	○	●	●	○	○	○	.050
○	○	○	○	○	○	●	○	○	○	○	○	○	○	●	○	○	.075
●	○	○	○	○	○	○	●	○	○	○	○	○	○	○	○	○	.100
○	●	○	○	○	○	○	○	●	○	○	○	○	○	○	●	○	.125
○	○	○		○	○	○	○	○	○		○	○	○	○	○	○	.150
○	○	○		○	○	○	○	○	○		○	○	○	○	○	○	.200
○	○	●			○	○	○	○	●			○	○	○	○	●	.250
○	○	○			○	○	○	○	○			○	○	○	○	○	.300
○	○	○				○	○	○	○			○	○	○	○	○	.312
○	○	○				○	○	○	○			○	○	○	○	○	.375
○	○	○				○	○	○	○			○	○	○	○	○	.400



V8 I



J1K



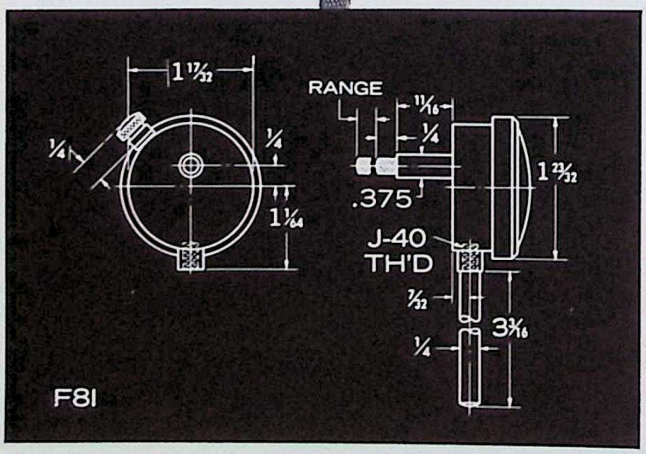
G40

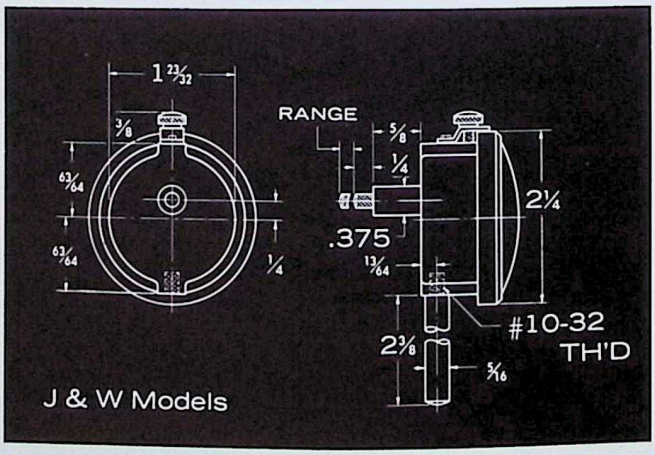
Normally furnished with Balanced Dial (plus on right). Other Dials optional at slight additional cost.

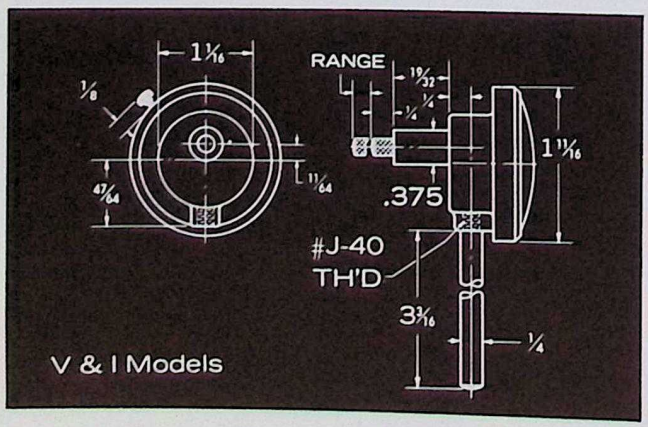
Perpendicular Indicators fill an important need when the application calls for dial reading at right angles to the spindle movement, as in machine table alignment. They are made with the same precise workmanship which characterizes Regular style Indicators. All Models have Full-Jeweled, low-friction Miracle Movements. G, J and W Models can be equipped with Tolerance hands, page 18. All models can be used with the stem-mounted accessories on pages 18 and 19.

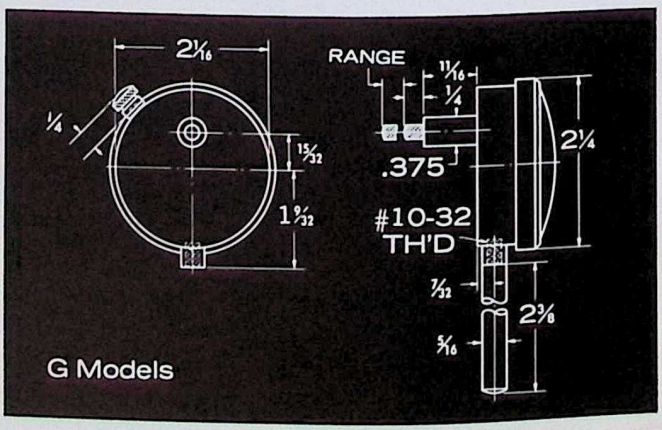
Most Federal Perpendicular Indicators have crown gear movements, noted for their smooth, highly accurate operation, permitting graduations as fine as .0001″. Movements can be aligned for precise rack and pinion mesh. To provide the advantage of longer range operation, Federal also offers several spiral gear models. Model F81 is normally furnished with .375″ diameter stem. Available also with .275″ diameter stem at no additional cost.

TRACING TEMPLATES AVAILABLE ON REQUEST





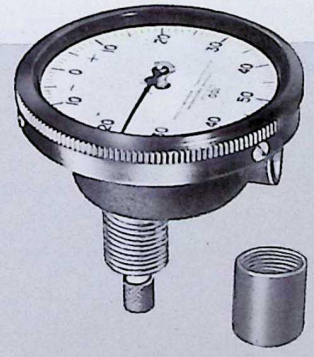




PERPENDICULAR

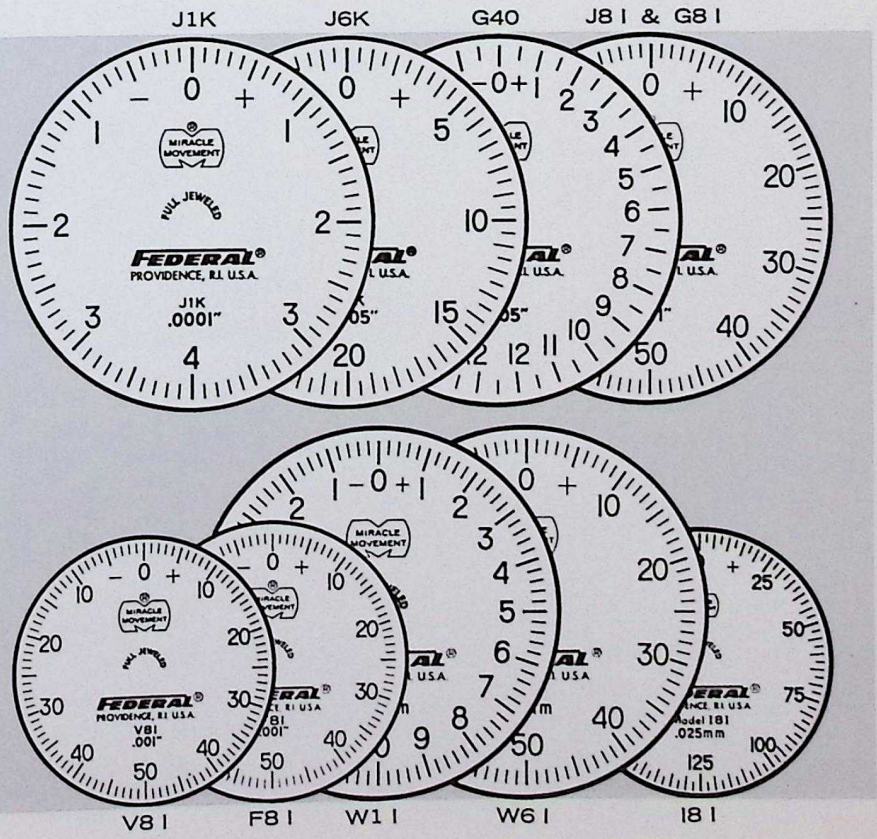
MIRACLE MOVEMENT / SHOCKPROOF

		ENGLISH *Values in Inches*							METRIC *(mm)*		
VALUE OF EACH GRADUATION		.0001	.0005		.001				.002	.01	.025
RANGE PER REVOLUTION		.008	.040	.025	.100				.200	1.00	2.50
TOTAL RANGE		.008	.040	.100	.100		.200		.200	1.00	2.50
MODEL		J1K	J6K	G40	J8 I	V8 I	F8 I	G8 I	W1 I	W6 I	I 8 I
TYPE	Crown Gear	√	√		√	√			√	√	√
	Spiral Gear			√			√	√			



STEM ADAPTORS

When an Indicator is to be stem mounted, a hardened steel adaptor should be used to protect the stem bushing against clamping pressure. Specify Adaptor AD-59 for J and V Models, AD-60 for G Models and for F8I with .375″ diameter stem. Perpendicular Models can be furnished with stem having ⅜″-32 thread for positive, secure fit to this adaptor.



ACTUAL SIZE

Normally furnished with continuous clockwise dial and revolution counter. Balanced dials (plus on right) optional at no additional cost.

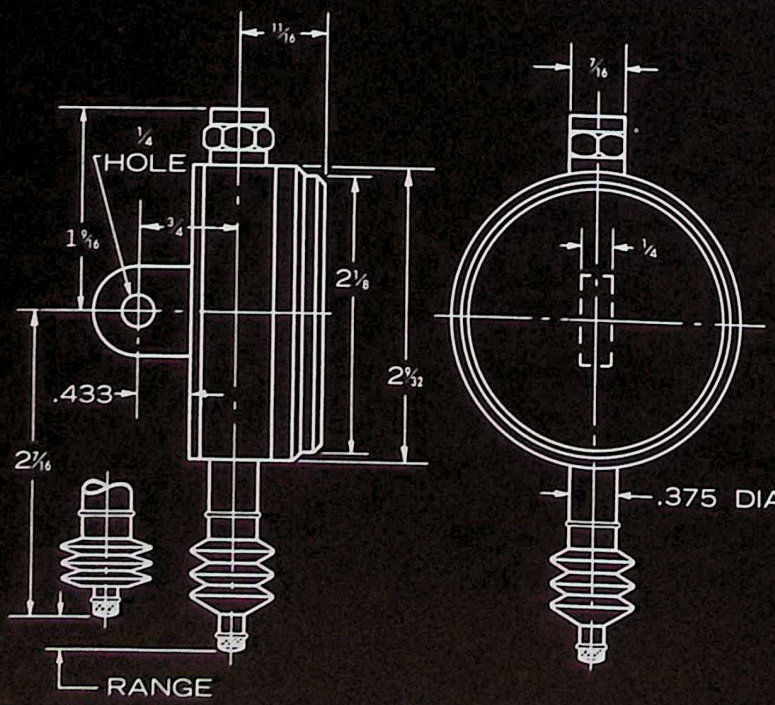
FOR PRECISE MEASUREMENT UNDER ADVERSE CONDITIONS

The Federal Wetproof Indicator performs effectively in most difficult situations. It is ruggedly built and protected against dust, coolant and oil fogs and other contaminants, even in considerable amounts. All seven Models, equivalent in size to Federal AGD Group 2 (C size) Indicators, have full jeweled, low-friction Miracle Movements and thus are made to extremely precise standards.

Normally furnished with a vertical (centered) lug Back attached by four, heavy duty screws. Other type backs available at slight additional cost.

TRACING TEMPLATES AVAILABLE ON REQUEST

Outside dimensions conform to AGD specifications except for distance from mounting bracket hole to end of contact point. Point is 5/8" long to accommodate boot.



Backs can be rotated 90° and 180°

FEATURES

1. POSITIVE SEALING

Protected by "O" Ring seals at dust cap, back cover and bezel.

2. PLIABLE BOOT

Stem bushing is sealed by soft rubber boot which hugs stem and contact. Does not impede travel of spindle.

3. HEAVY DUTY CASE

Cast metal case, precision machined to maintain rigidity under adverse conditions.

WETPROOF

MIRACLE MOVEMENT / SHOCKPROOF

ENGLISH

Values in Inches

VALUE OF EACH GRADUATION	.0001	.00025	.0005				.001
RANGE PER REVOLUTION	.010	.020	.020	.030	.040	.050	.100
TOTAL RANGE	.025	.050	.050	.075	.100	.125	.250
MODEL	W-C2 I	W-C3K	W-C3Q	W-C5M	W-C6K	W-C7 I	W-C8 I

Metric Models W-P6 I, W-P3 I and W-P1 I also available. Characteristics same as Metric Models, page 9, except they are normally furnished with continuous, clockwise dials.

4. ADJUSTABLE BEZEL

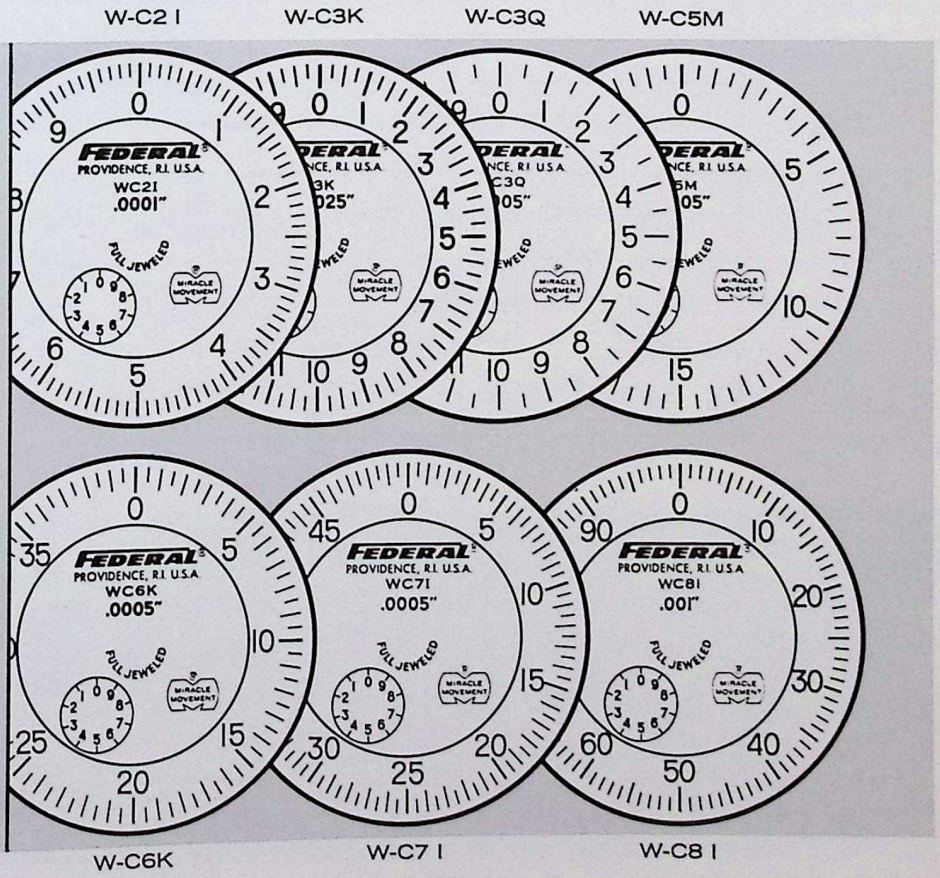
Though sealed, it can be adjusted to set zero precisely. Equipped with locking ring so setting can be maintained despite machine vibration.

5. GLARE-PROOF CRYSTAL

Special glass has low reflectivity and won't discolor.

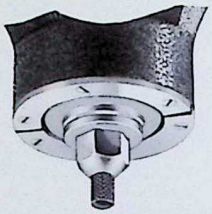
6. LASTING ACCURACY

Full-Jeweled Miracle Movement with continuous clockwise dial.



Super Sensitive

C½K



Spindle is sealed against dirt and dust.

C1KB

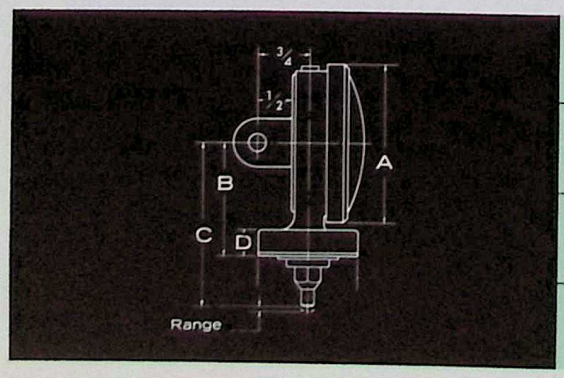
AGD TYPE

Conforms to AGD Group 2 dimensions (see diagram, page 8) but offers higher magnification. Upper end of spindle is supported by reed spring for more accurate movement. Dials, backs and points same as AGD Group 2 Models.

BELLOWS TYPE

Ruggedly built and extremely accurate. Spindle response is frictionless. Sealed support of spindle protects mechanism from dust and dirt, so Indicator can be used in shop as well as lab. Normally furnished with balanced dial, vertical (centered) lug Back and ¼" long, hardened steel point. Other dials, backs and points are also available.

ENGLISH *Values in Inches*		ENGLISH *Values in Inches*				METRIC *Values in mm*		
.00005	VALUE OF EACH GRAD	.00005	.0001			.001	.002	
.004	RANGE PER REVOLUTION	.008	.008			.200	.200	
.010	TOTAL RANGE	.008	.008			.200	.200	
C½K	MODEL	E1DB	C1KB	D1KB	E1KB	R1BB	P1IB	Q1IB
	A	3⅝	2¼	2¾	3⅝	3⅝	2¼	2¾
	B	2³¹⁄₆₄	1³⁹⁄₆₄	2³⁄₆₄	2³¹⁄₆₄	2³¹⁄₆₄	1³⁹⁄₆₄	2³⁄₆₄
	C	3³⁄₁₆	2¹¹⁄₃₂	2¾	3³⁄₁₆	3³⁄₁₆	2¹¹⁄₃₂	2¾
	D	²⁹⁄₆₄	²³⁄₆₄	¹⁵⁄₃₂	²⁹⁄₆₄	²⁹⁄₆₄	²³⁄₆₄	¹⁵⁄₃₂



HIGH MAGNIFICATION DIAL INDICATORS

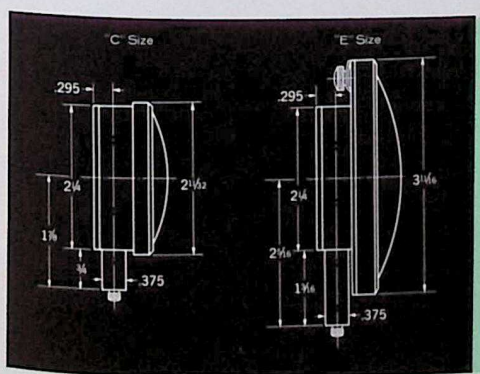
Shown Actual Size

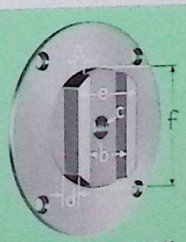
Domestically made, Micro-Sure Dial Indicators are ultra-high magnification instruments which combine lab accuracy and shop toughness. Instead of the conventional rack and pinion, the Micro-Sure movement features precisely ground, hardened and lapped cam surfaces for more accurate motion transfer and reduced friction. The movement follows the spindle motion (rather than being driven by it), providing at least .035″ of overtravel and protecting the indicator from shock damage.

All Micro-Sure Indicators have only one revolution, eliminating reading errors caused by multiple revolutions. Repeat accuracy is to within one fifth of a division and calibration accuracy is to within one division over the full range.

Because their cases basically conform to AGD specifications, these Micro-Sure Indicators may be used in existing fixtures without modification. The rugged .375″ diameter stainless steel stem is integral with the indicator case assuring rigid stem mounting. Optional adjustable and bracket backs are available for alternate mounting arrangements.

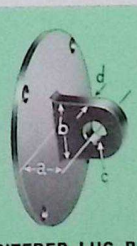
	ENGLISH *Values in Inches*		METRIC *Values in um*	
VALUE OF EACH GRAD	.000020		.5	
RANGE PER REVOLUTION	.0016		40	
TOTAL RANGE	.0016		40	
MODEL	IND-101 ("C" Size)	IND-105 ("E" Size)	IND-102 ("E" Size)	IND-103 ("C" Size)





ADJUSTABLE BACK, BK-112*

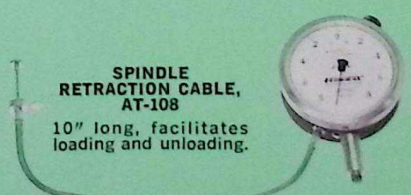
a = ⅛″ d = ¼″
b = ½″ e = ⅞″
c = ¼″-20 f = 1¼″



CENTERED LUG BACK, BK-113*

a = ½″ c = ¼″
b = 1 1/16″ d = ¼″

*All backs can be rotated 90° and 180°.



SPINDLE RETRACTION CABLE, AT-108

10″ long, facilitates loading and unloading.

Electric Dial Indicator

TWO-LIMIT MODEL

FOUR-LIMIT MODEL

The Federal ELECTRICATOR is a regular Miracle Movement Dial Indicator (C size) combined with a precision, two or four limit switch actuated by the Indicator spindle. It is widely used with Light Indicating Unit 131B-3 (see below) to provide signal light indication of work size or condition. Thus, when used on a bench comparator, the Electricator greatly speeds up inspection, assures accurate results even with relatively unskilled help. Switch operates independently of Indicator, is accurate to within 50 millionths of an inch. Lights show work category. Dial shows actual size.

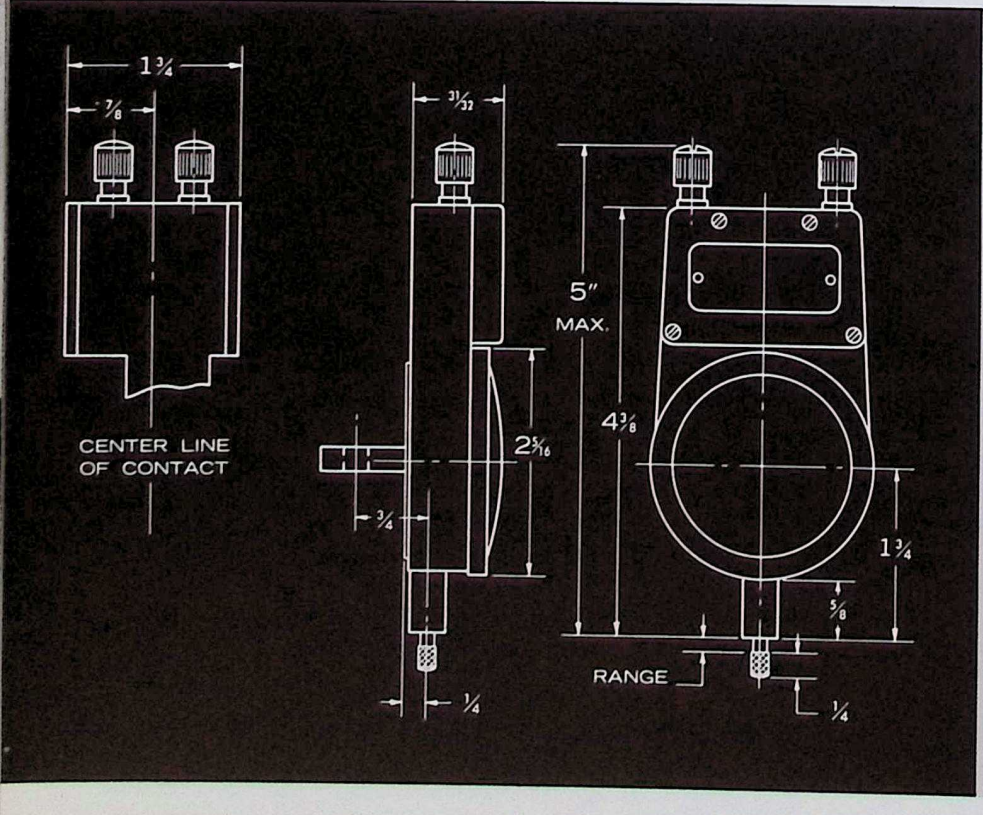
The Electricator has a calibrated dial and can be set with only one master. Switching limits are easily set by means of adjustment screws on top of enclosure. Switching current is extremely low to maintain high accuracy by eliminating burning, pitting or sticking of contacts. Mounting dimensions conform closely to AGD, so it is easy to mount the Electricator in place of regular Indicator to greatly upgrade gaging speed economically. Can be furnished with Light Panel or separate Light Indicating Units for greatly increased speed in multi-dimensional gaging.

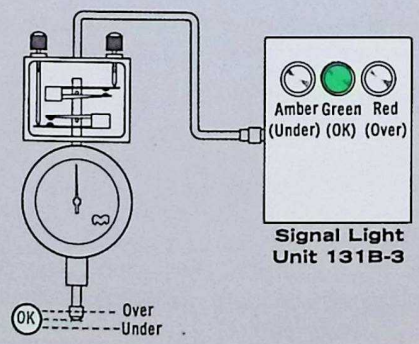
Also available: (ask for Catalog 65 AM)

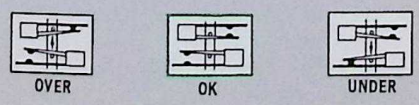
1. **The ECCENTRICATOR** — measures eccentricity, wobble, etc. without influence from piece-to-piece variation in work size.
2. **TWO-LIMIT SWITCH** — The Electricator's switching portion only. Sets up using a regular Dial Indicator.

Furnished with Complete Instructions

TRACING TEMPLATES AVAILABLE ON REQUEST







Switching mechanism of Electricator is spindle operated. On two-limit models, two independent sets of contacts permit three switching conditions for classifying into "over", "good" and "under". Four-limit Models have four sets of contacts, permit classifying into the above categories plus "near Over" and "near Under".

ELECTRICATOR

MIRACLE MOVEMENT / SHOCKPROOF

	TWO LIMIT *Values in Inches*						FOUR LIMIT *Inches*	
VALUE OF EACH GRADUATION	.0001	.00025	.0005			.001	.0001	.0005
RANGE PER REVOLUTION	.010	.020	.030	.040	.050	.100	.010	.050
TOTAL RANGE	.050	.050	.100			.100	.050	.100
MODEL	134B-2	134B-3	134B-5	134B-6	134B-7	134B-8	134B-22	134B-27
LIMIT ADJUSTMENT* HIGH	−.010 to +.035		−.010 to +.025				Same as 134B-2	Same as 134B-7
LIMIT ADJUSTMENT* LOW	−.015 to +.010		−.025 to +.010					

** From zero position of Indicating Hand*

CONTACTS .....Palladium
SWITCHING VOLTAGE* .....8 v.
SWITCHING CURRENT* .....1 ma.
**when used with Light Unit 131B-3*

NORMALLY FURNISHED WITH:

Balanced Dial (plus on right) and Revolution Counter

Horizontal (centered) lug Back

5 foot connecting cord with plug to fit Light Unit.

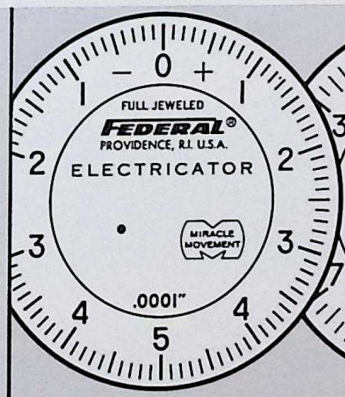
Also available:

Other backs . . . see Price List

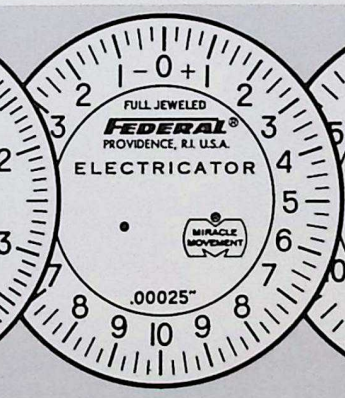
Continuous, clockwise dials (no extra cost)

Cord with stake-on connectors (no extra cost)

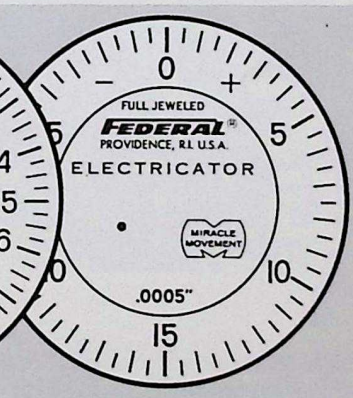
134B-2 & 134B-22



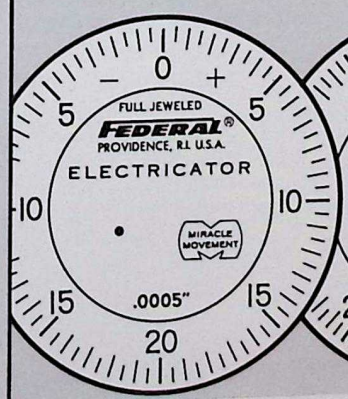
134B-3



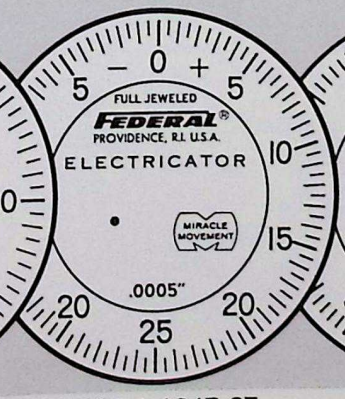
134B-5



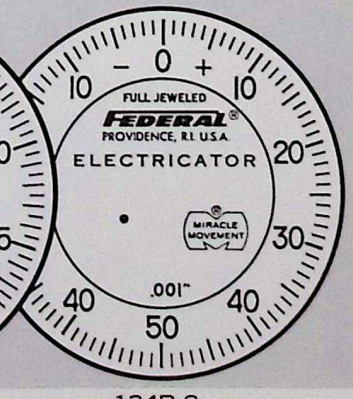
134B-6



134B-7 & 134B-27



134B-8

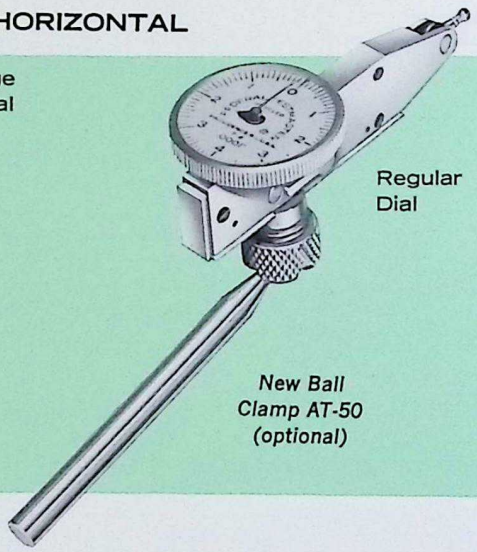


Styles and types to suit every need

Holding Bar and Swivel Clamp (normally furnished)

HORIZONTAL

Large Dial



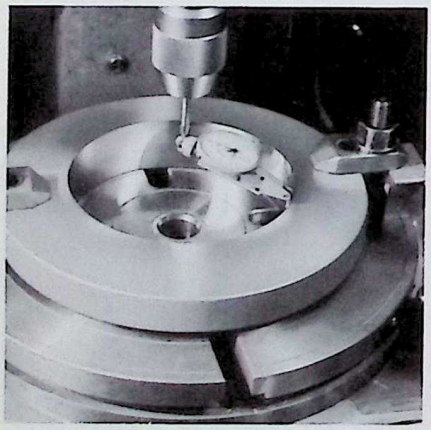
Regular Dial

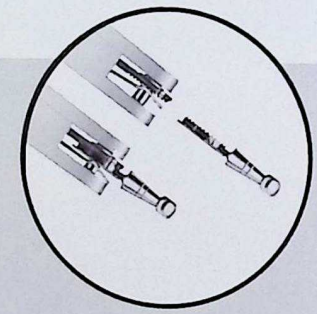
New Ball Clamp AT-50 (optional)

Double-jointed Clamp AT-100

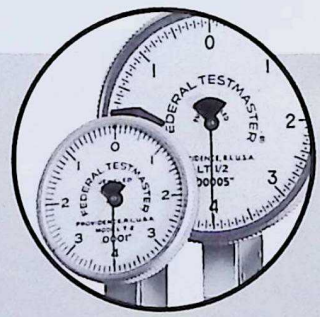
For millers and jig borers. Reaches up to 3¼ or 5" according to style of Testmaster.

PERPENDICULAR

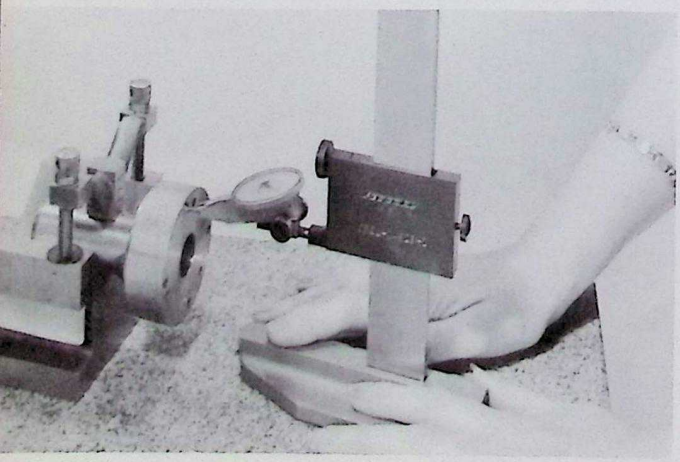




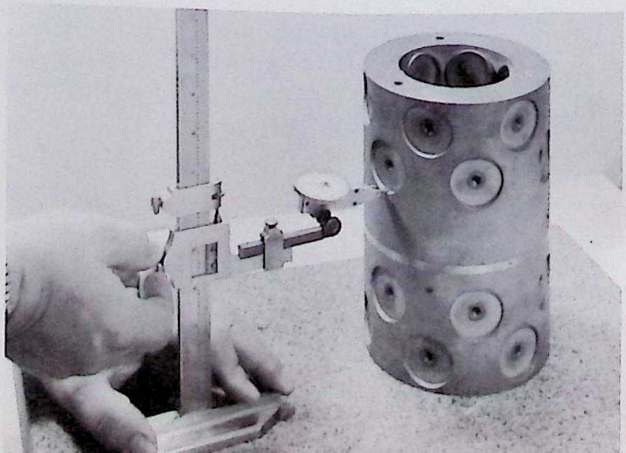
Precision point is hard chromed for durability, has ratchet base which locks in mating ratchet under spring pressure, yet can be easily indexed or removed. Tungsten carbide points available also.



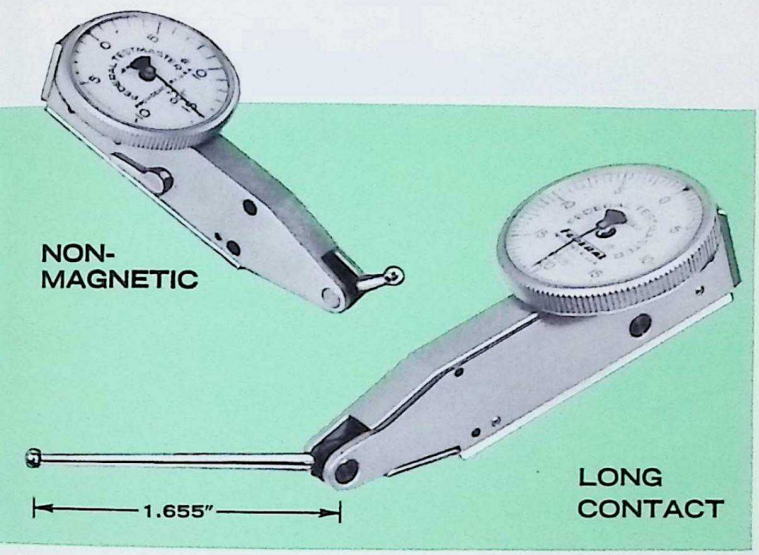
Regular dial (1" dia.) and large dial (1½" dia.) models available. Hands are uniquely counterbalanced for low inertia. Dial is adjustable by rotating bezel to set zero at any position.



Testmaster can be mounted on many types and makes of Height Stands, Test Sets and other holding fixtures by means of Holding Bar and Swivel Clamp which are normally furnished.



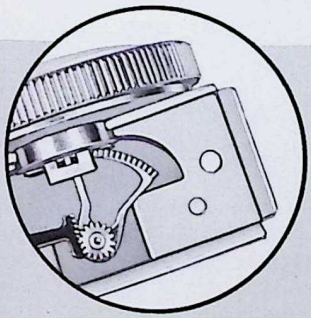
TESTMASTER



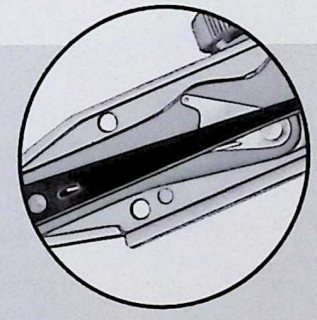
The world's most imitated, best liked Test Indicator

The Federal Testmaster is the design standard on which many present day test indicators are based. Many additional makes of test indicators are imitations of the Testmaster almost part for part. It's not surprising because almost every important improvement in test indicators originated in the Testmaster . . . gear train mechanism, dovetail slides, low inertia hand, contact point with ratchet indexing, full-jeweled bearings, light weight gearing and cast metal case. Many of these improvements are patented and thus not found in other makes.

And the Testmaster is now better than ever. Recent improvements in the internal mechanism have produced unmatched accuracy and sensitivity and, for the first time, have made it possible to offer a test indicator graduated in 50 millionths of an inch.



Gears are light weight for super-sensitive response without sacrificing strength, have precisely hobbed teeth. All bearings are jeweled for low friction, exceptional resistance to wear.



Rigid satin-chromed, cast-metal case protects alignment of movement, rigid steel lever provides faithful transfer of motion. Easily set lever switch reverses direction of contact pressure.

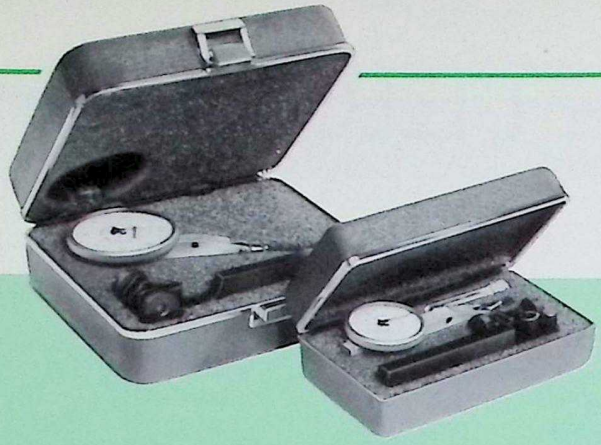
Dovetail slides at bottom and end of case offer wide choice of attachment location, are cast integrally with case so can't come loose. Fit swivel clamp or universal ball clamp.

Federal Testmasters have now been consolidated into two main Series (T for regular dial models, LT for large dial models.) Included in the T series are four non-magnetic models. In all, there are more than 20 Testmaster models, providing enough choice to meet virtually every test indicator need.

Federal also provides a choice of contact point sizes in hard chromed steel and tungsten carbide. Because contacts can be so easily interchanged, it is to the user's advantage to order several size points for each Model. The Testmaster's new style protective case provides a place for convenient storage of extra points. The proper contact point *length* differs for certain models (.398″ for those having .001″ and .0005″ grads, .331″ for those having .0001″ and .00005″ grads and .418″ for certain metric models) so points are banded for easy identification, as explained on Instruction sheet furnished with each Testmaster.

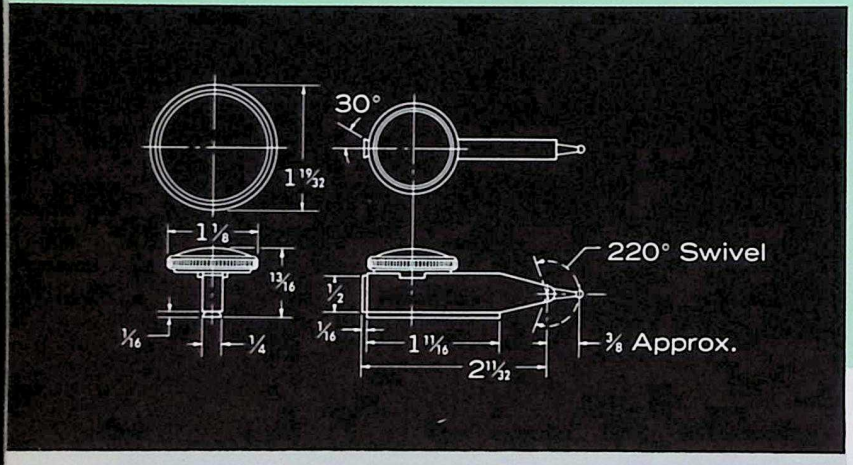
The Federal Testmaster is a precision instrument of great versatility. Its small size, light contact pressure, reversible contact motion, wide range of contact position and choice of mounting arrangement permits it to make an amazing variety of measurements, many of which are impractical or impossible with other types of dimensional instruments. Its full-jeweled movement, combining rigid lever and strong but lightweight crown gear, provides exceptional sensitivity and repetitive accuracy.

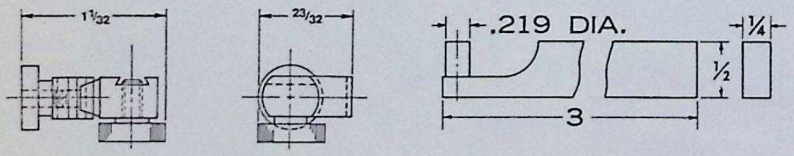
All Testmaster models now incorporate recent improvements to the internal mechanism which have substantially reduced friction and gaging pressure. These, plus external improvements described above provide the Testmaster with measuring dependability unmatched by any other test indicator.



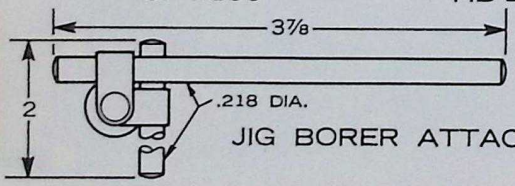
Testmaster is normally furnished with Swivel Clamp and Holding Bar in new style protective case. Contact point is .100″ dia. Hard chromed steel unless otherwise specified. Space is provided for storage of extra points. Complete instructions are furnished.

VALUE OF EACH GRADUATION		
TOTAL RANGE		
STYLE		
MODEL	REGULAR DIAL	
	LARGE DIAL	
	NON-MAGNETIC	



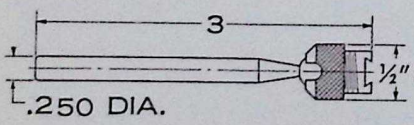


SWIVEL CLAMP and HOLDING BAR
CP-2199 HB-2157

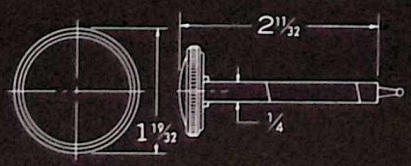


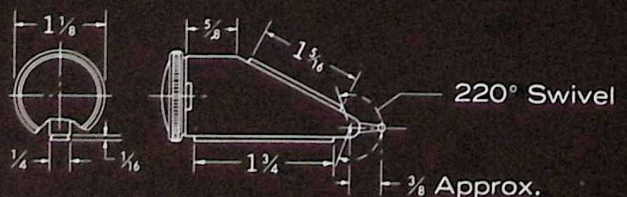
JIG BORER ATTACHMENT RD-21

TRACING TEMPLATES AVAILABLE ON REQUEST



BALL CLAMP
AT-50





POINT IDENTIFICATION

Because .001″ and .0005″ grad Testmasters require points having a length which differs slightly from those on .0001″ and .00005″ grad Models, identification grooves have recently been placed on these points as shown in table below, and included with Instructions furnished with each Testmaster.

WHEN ORDERING EXTRA POINTS BE SURE TO FURNISH PART NUMBER OF POINT OR MODEL NUMBER OF TESTMASTER.

CONTACT POINTS

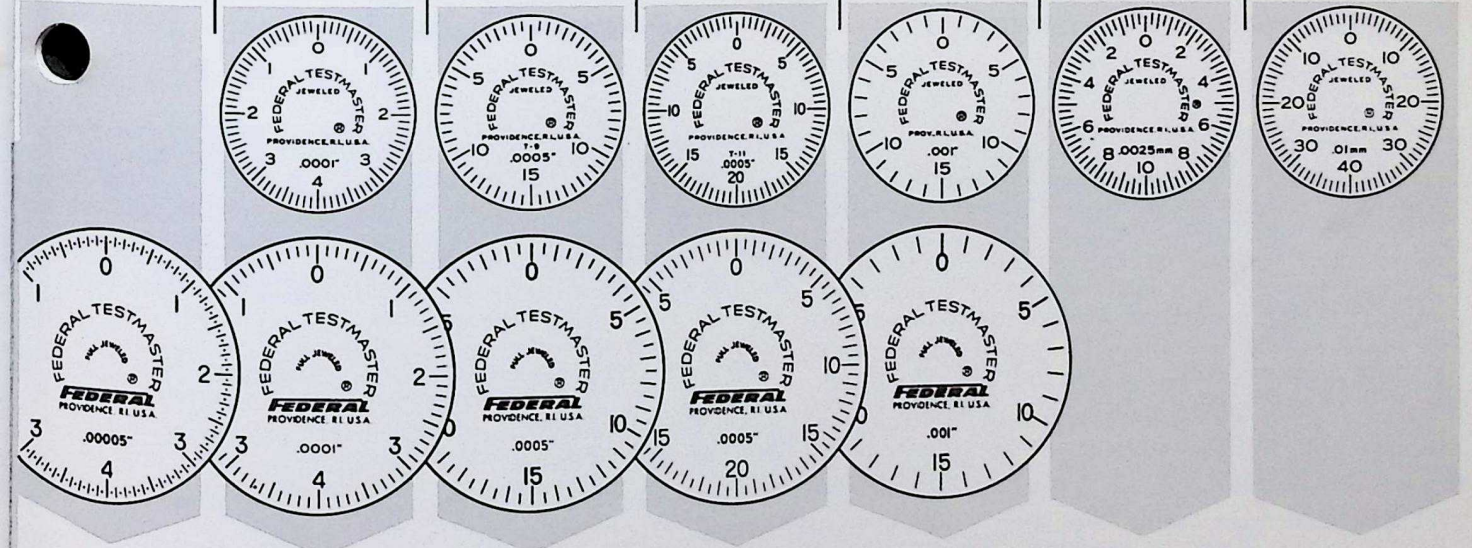
STEEL (Hard chrome)	*Normally furnished*	.100″ Dia.
	Optional in place of above — no extra cost.	.031″ "
TUNGSTEN CARBIDE	*Optionally available at slight extra cost. .093 normally furnished on all non-magnetic models.*	.093″ "
		.062″ "
		.031″

IDENTIFICATION GROOVES

TESTMASTER

Specifications

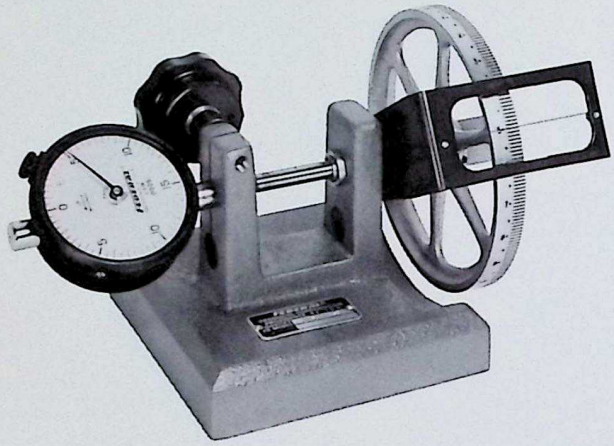
ENGLISH *Values in Inches*										METRIC *Values in mm*			
.00005		.0001		.0005				.001		.0025		.010	
.008		.008		.030		.040		.030		.200		.800	
Horiz.	Perp.	Horiz.	Perp.	Horiz.	Perp.	LONG CONTACT Horiz.	Perp.	Horiz.	Perp.	Horiz.	Perp.	Horiz.	Perp.
•	•	T-2	T-6	T-9	•	T-11	•	T-1	T-5	T-3	T-7	T-4	T-8
LT-½	LT-13	LT-2	LT-6	LT-9	LT-10	LT-11	LT-12	LT-1	LT-5	•	•	•	•
		T-2NM						T-1NM		T-3NM		T-4NM	



PT-4	PT-4	PT-3	PT-202	PT-3	PT-4	PT-36
PT-2	PT-2	PT-1	•	PT-1	PT-2	•
PT-174	PT-174	PT-173	•	PT-173	PT-174	PT-175
PT-188	PT-188	PT-186	•	PT-186	PT-188	•
PT-187		PT-185	PT-217	PT-185	PT-187	•
			NONE			NONE

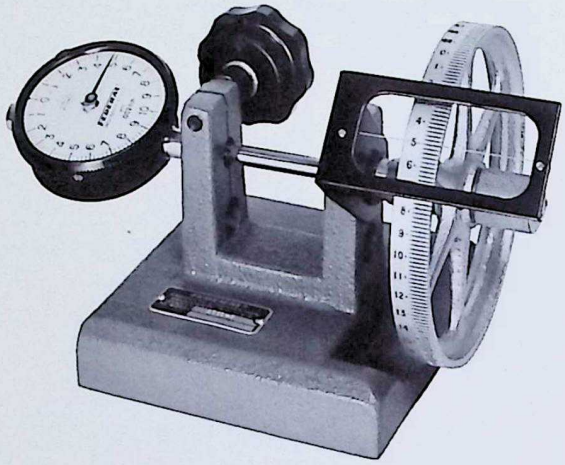
CALIBRATOR

MODEL 400B-3



FOR INCH MODEL INDICATORS

MODEL 400B-4



FOR METRIC MODEL INDICATORS

Federal offers reliable, easy-to-use calibrating fixtures for inch and metric dial indicators with ranges up to 1″ or 25mm. A sturdy cast iron base holds a precision micrometer head featuring a large, graduated wheel for quick reading and ease of operation. The tungsten carbide anvil on the end of the micrometer spindle provides maximum resistance to wear. The cross-hair bracket adjusts easily to the best viewing position for the operator.

In use, a dial indicator is clamped in the fixture directly in line with the micrometer spindle. After zeroing, any deviation from predetermined calibration points anywhere within the range of the indicator can be read in .0001″ or 0,002mm increments on the large wheel.

The calibrating fixtures will accept any dial indicator with a .375″ stem. In addition, three adaptors are supplied for indicators with other stem diameters: BU-112 for $^{7}/_{32}$″ diameter stems (miniature model indicators — "A" and "N" size), AD-58 for .275″ stems (an option on some perpendicular model indicators) and BU-146 for 8mm stems.

SPECIFICATIONS

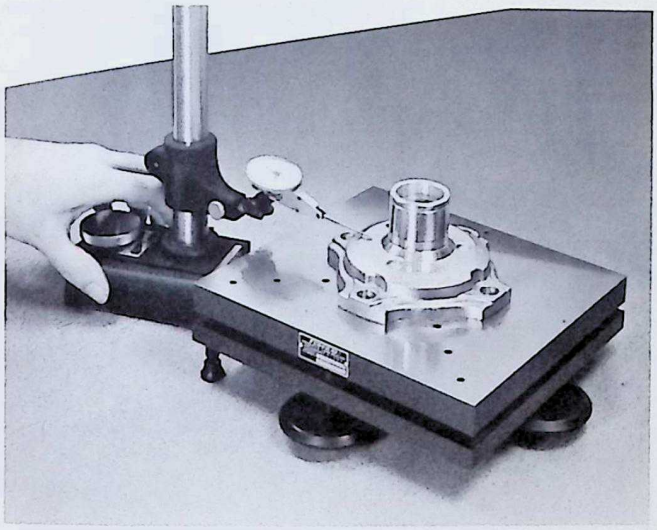
	Inch	Metric
Model Number	400B-3	400B-4
Capacity	0-1″	0-25mm
Minimum Graduation	.0001″	0,002mm
Weight	4½lbs.	2kg

Accuracy — within .000050″/0,001mm between any two calibration points.*

*As specified in Federal Specification GGG-105B for micrometer calibration.

LEVELING TABLE

...cuts set-up time 60% or more for many height gage measurements



MODEL TE-20

Permits you to quickly bring the surface of a part into alignment with surface plate in both planes. Completely eliminates shimming. Saves so much time that, used only occasionally, it will pay for itself in two weeks.

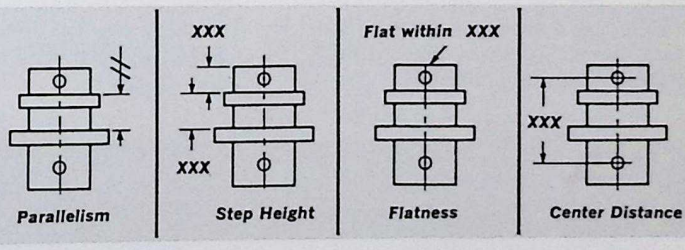
Top plate is stress-relieved steel providing about 67 square inches of work area. It is drilled and tapped for fixtures. Fine pitch screws and large knobs assure precisely controlled adjustments. Works with any type of height gage.

Operation is simple. Height gage readings are taken at edges of surface to be aligned. Each plate, independently adjustable at right angles to the other, is angled as required for precise alignment.

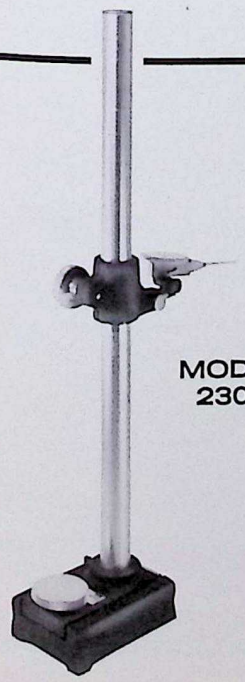
ADJUSTMENT	Top Plate	Bottom Plate
Total	±1° 30′	±1° 30′

Typical checks which require careful positioning of work because rest surface is not sufficiently parallel to other work surfaces.

Leveling Table compensates for error quickly, drastically reduces set-up time.



HEIGHT STAND



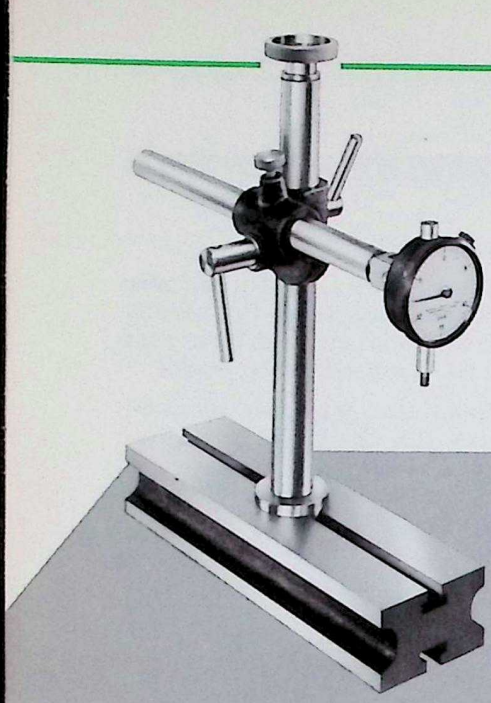
MODEL 2300

The Model 2300 Height Stand combines high precision and stability with low price and ease of adjustment. The base has three point support and is contoured for easier handling. It is designed so that any heat transferred from hand is isolated from the column and its adjustment. Column allows measurements at heights up to 18″, has smooth finish for easy positioning of arm.

Fine adjustment of height is provided at base where it can be made quickly and conveniently and can operate smoothly over a wide range.

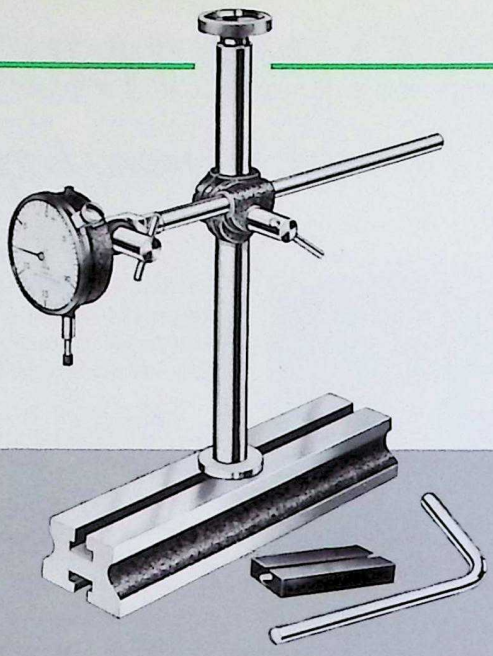
Diameter of mounting post is right for Testmaster swivel clamp, can be removed for substitution of scribe marker or other transfer device. Large clamp holds arm securely without need for additional locking.

Maximum Vertical Capacity	18″	Mounting Post	7/32″ dia.
Fine Adjustment Range	up to .030″	Column	.995″ dia., 17″ long
Reach (base to contact point)	3 3/8″ approx.	Base	3″W, 4 3/8″L, 1 1/4″H



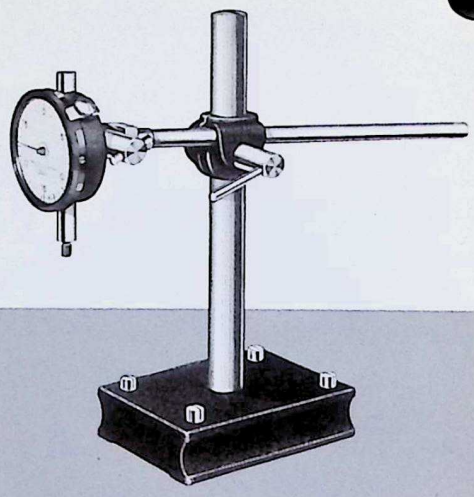
731 & 731A

For heavy duty. Post and Holding Rod are extra rigid. Wide base. Knurled knob atop post provides secure locking at any point along base. Each adjustment has separate clamp so setting can be made quickly without disturbing others.



730

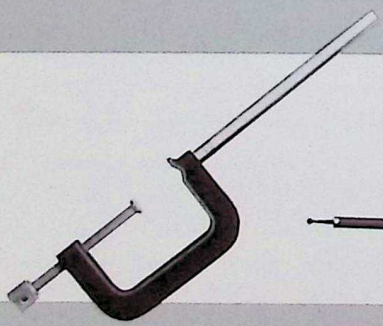
Large diameter tubular post clamps at any point along base by means of knurled knob at top. Separate clamps for Holding Rod height or angle and Indicator position. Tool Post Clamp, Slide Support Rod and Adapter included in set.



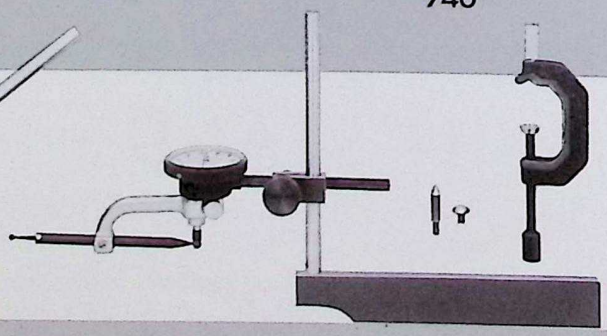
733

Base is heavy and wide for firm support. Gage pins at corners push down to extend below base as guides against edge of surface plate, T slot etc. Bottom of base is relieved to allow easy movement, three point support.

AT-7341



740



CLAMP ATTACHMENT

Clamp attaches to any spindle, arbor, etc. having diameter between 9/16" and 2¾". Permits use of Dial Indicator or Testmaster in wide choice of locations and positions. An Adaptor is available — BU-16, not included — so that Clamp Attachment can be used with swivel and holding rod from Test Sets having a .738" diameter post (such as Models 730, 733, 744, 744A).

Clamp capacity	3/16" to 2¾"
Rod	.375" diameter, 5¾6" long
Adapter BU-16	.375" I.D., 738" O.D.

TOOL POST TYPE TEST SET

Dimensioned to fit tool posts for checking machine set-ups. Perpendicular style Indicator can be used alone, or with Hole Attachment for reaching internal dimensions at depths up to 1 11/16". Upright threads into C-Clamp for mounting at other locations. Taper and button points are furnished for use in place of regular point.

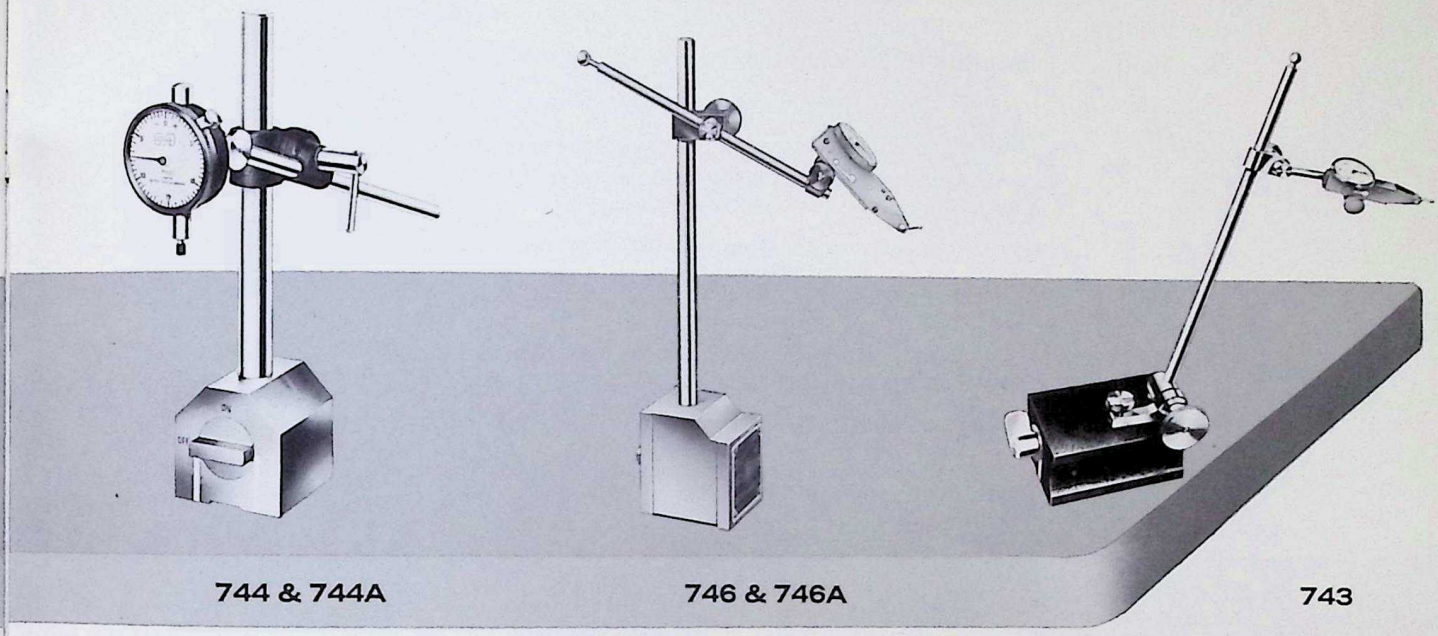
INDICATOR	V81	I8I
Min. grad.	.001"	.025 mm
Range	.100"	2.50 mm

HOLDING ROD – ¼" dia. x 3¾6"
UPRIGHT – .312" dia. x 5"
BASE – ⅜" wide x ⅞" high x 6" long

INDICATOR (English) Values in Inches	MODEL
	MIN. GRAD.
	RANGE
HOLDING ROD	DIAMETER
	LENGTH
POST	DIAMETER
	LENGTH
BASE	WIDTH
	LENGTH
	HEIGHT
INDICATOR (Metric) Values in mm	MODEL
	MIN. GRAD. / RANGE

TEST SETS

with English or Metric Indicators



744 & 744A

746 & 746A

743

Base can be used conventionally on surface plate or, by means of lever, can be made magnetic to clamp firmly against any ferrous surface. Strong holding force allows use in any position. Solid post makes set extra rigid.

Compact base can be made magnetic by push-button, holds firmly to any ferrous surface in any position — upright, horizontal, or upside-down. Magnetized V-surface at top of base allows secure attachment to spindles, arbors etc.

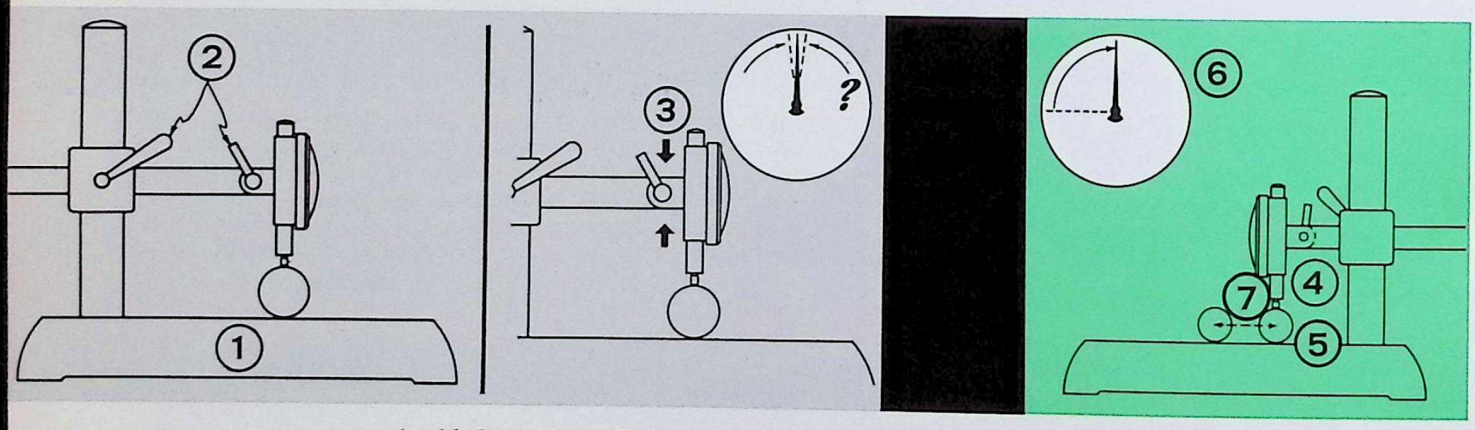
Heavy base firmly supports Testmaster for surface plate checks, can be magnetized by lever for secure clamping against iron or steel surfaces in any position. Fine adjustment of holding rod makes set-up faster, locks securely.

	731	731A	730	733	744	744A	746	746A	743
	C5M	C2 I	C5M	C5M	C5M	C2 I	T-1	T-2	T-1
	.0005	.0001	.0005	.0005	.0005	.0001	.001	.0001	.001
	.075	.025	.075	.075	.075	.025	.030	.008	.030
	.738		3/8	3/8	3/8		1/4		7/32
	9 5/8		9	9	9		5 1/2		2
	.987		.738	.738	.738		.500		5/16
	10		8 3/4	8	7 13/16		7		9 3/8
	3		2 1/4	3 1/4	2 7/16		1 5/8		2 7/16
	10		8 1/2	4 1/4	2 3/4		1 7/8		3 1/8
	1 3/4		1 11/32	1 1/8	2 7/16		1 15/16		1 5/16
	P6 I	P1 I	P6 I	P6 I	P6 I	P1 I	T-4	T-3	T-4
	.010 / 2.5	.002 / .50	.010 / 2.5	.010 / 2.5	.010 / 2.5	.002 / .50	.010 / .80	.0025 / .20	.010 / .80

Getting the most from your Indicator...

Setting Up

1. Select a stand or fixture (see below) which is rigid and stable enough to keep Indicator in precise position.
2. Make sure that clamps for Indicator and Arm are very tight.
3. To test rigidity . . . press down on Indicator with sufficient force to move Indicator hand several dial divisions. Release pressure very slowly. Note any change from original reading. Repeat procedure in opposite direction. If total difference in readings is one graduation or more, chances are stand is not rigid or stable enough.
4. Use as little post height and arm length as possible. This improves rigidity of stand considerably.
5. Make sure reference surface is clean. It should be flat within 10% of Indicator's graduation value over the area in use.
6. Indicator position should be adjusted so hand is at least ¼ turn from the "at rest" (9 o'clock) position to assure positive contact pressure.
7. Always test your set-up for repeat accuracy. Your set-up should repeat its readings within ⅕ of a dial division.
8. Wherever practical use a master having the same form as that of the work being measured (e.g. cylindrical master for cylindrical work)



Operation

Avoid sharp blows. Federal Miracle Movement Indicators are shock-proof but this does not fully protect them against abuse.

Avoid excessive side pressure; use a Lifting Lever (page 18) to clear piece being placed in position.

When changing contact points, avoid excessive tightening. Federal contacts are relieved at shoulder so finger tightness is sufficient.

Test your set-up periodically.

Care and Maintenance

Do not oil spindle bearings. If spindle sticks after prolonged storage, working the spindle back and forth several times will free the movement.

Movement bearings can, if necessary, be oiled lightly when Indicator is used around acids, heat, or contaminants. Oil sparingly with highest grade watch oil.

Wipe spindle carefully with clean rag before and periodically during use to protect precision bearings. Use only soap and water to clean crystal. If Indicator must be cleaned internally, send for Dis-assembly and Assembly Instructions.

Keep Indicator in its box or some protective enclosure when it is not in use so it won't be exposed to grime or get hit by hand tools.

Repair

Even *Federal* Indicators don't last forever. When repairs are needed, have them performed by factory trained specialists. For your convenience Federal maintains complete repair facilities at Los Angeles, Detroit, Chicago and Providence. Addresses are given on back cover of this Catalog.

When returning Indicators for repair, please pack them in wadding or with spacers to protect against damage in transit.

SELECTING THE RIGHT MODEL

Modern production involves a wide range of tolerances. Because of this many different models of Dial Indicators are required to suit the majority of needs economically. Selection of the right Model can be simplified in many instances by using the following guide. It is best suited to choosing an Indicator for comparative measurement in production gaging.

You are mainly concerned with four characteristics:

1. ***Minimum Graduation Value*** — the value of the smallest graduations marked on the dial. (Federal offers five different minimum graduation values in the English system, plus Metric equivalents.)

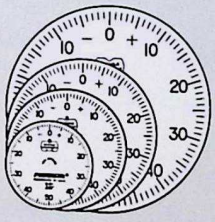
2. ***Size*** — usually referred to in terms of the Bezel diameter. (Federal offers up to five different sizes of Indicators having a certain minimum graduation value.)

3. ***Range Per Revolution*** — represents the travel of the Indicator spindle as the hand makes one revolution of the dial. (Federal offers up to four different ranges per revolution for each value of minimum graduation.)

4. ***Total Range*** — the maximum distance over which the Indicator spindle can travel. (Usually this represents 2½ revolutions of the hand but many models are available in longer and shorter ranges, see page 20.)

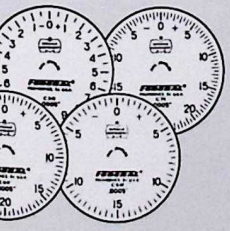
By considering these characteristics in order you can easily select a model of Indicator which suits your particular need.

.0005 .001
.0001 .00025
.00005



1 ***Minimum Graduation Value*** — Select from five different values available the one which is closest to 10% of the tolerance spread of the work to be measured. This assures that the tolerance will span about 10 divisions on the dial.

Example: Tolerance spread is .006" (±.003"). Most suitable minimum graduation value is .0005".



2 ***Size*** — select on the basis of space available for the Indicator and the distance from which it will be viewed. Dials are shown full scale on the various pages so Catalog can be set at expected viewing distance and sizes compared for best readability. C size (bezel diameter of 2¼") is the most popular.

3 ***Range Per Revolution*** — Refer to the dials available in the chosen size and having the required minimum graduation value. Select the range per revolution which allows the tolerance spread to occupy 1/10 to ¼ of dial.

Example: Tolerance spread is .006". Proper minimum graduation value is .0005". C size dial is required. Of the four available Models in this size and minimum graduation value (see left) Model C5M has a range per revolution which is about midway between extremes.

4 ***Total Range*** — All AGD Indicators, and many other types as well, have a Total Range which is 2½" times the Range Per Revolution. It is adequate for most needs. However, if it is too little or too much to suit your job requirements, select from a wide choice of Special Ranges shown on page 20. If you still can't find the range you'd like, write us. Chances are we can supply it.

Example: Model selected is C5M. Total range is .075", but at least .200" is needed so Indicator spindle can clear lip of part. Table on page 20 shows that Special Ranges up to .400" are available in this Model. Range of .250" is selected. Lifting Lever is also specified from Accessories, page 18, to provide easy spindle retraction.

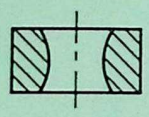
The Importance of Jeweled Bearings

The number of devices which use bearings of one sort or another is legion. In virtually every one of the countless applications for bearings the prime requirement is freedom from friction so that a minimum of force is required to produce motion, little or no heat results and wear is imperceptible over a long period of time.

Where miniature parts are involved — as in watches, electrical meters and precision dimensional indicators, man-made sapphire jewels are used extensively to provide the bearing surface. There is substantial reason for this.

wall profile which is essentially straight. Unless the axis of the staff is absolutely parallel with the hole axis (a condition which is rarely, if ever, realized) the two surfaces meet over a very limited, wear producing area (Figure 3). Couple this difficulty with the comparative softness of the material involved and you can appreciate the much greater rate of wear in plain metal bearings and the consequent loss of Dial Indicator accuracy.

While natural sapphire is extremely brittle, and thus not suitable, the man-made sapphire used for bearing applications contains additives which impart a toughness and



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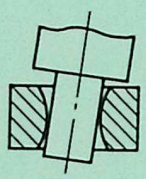

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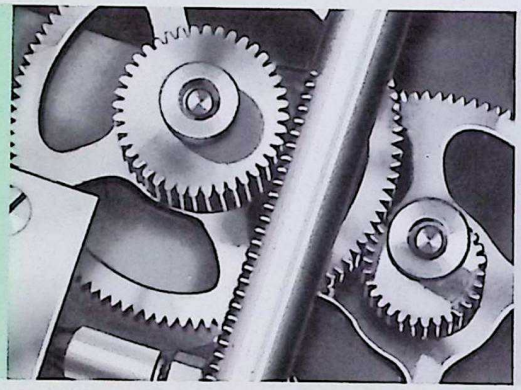
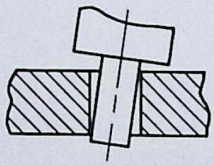




3

Man-made sapphire is extremely hard, harder than most commercially available substances except diamond. Because of this, plus the fact that it is completely homogeneous, man-made sapphire takes an extremely fine finish (in the order of less than a micro-inch). The result is a bearing surface which has a remarkably low coefficient of static and dynamic friction regardless of what material revolves in it. This low friction factor coupled with superior hardness enables the man-made sapphire bearing to operate for many millions of cycles in a Dial Indicator without measurable wear, exceeding plain metal bearings in this regard many times over.

The methods developed to produce jeweled bearings provide other margins of superiority over plain metal bearings. They result in what can be generally described as an hour glass cross-section, (Figure 1). The rounding of the wall profile not only presents a well radiused bearing surface to the staff or pivot which revolves in it, but also permits some leeway in the parallelism between the axis of the staff and the axis of the hole (as exaggerated in Figure 2) without binding or otherwise adversely affecting the bearing's operation. In contrast to this, the plain metal bearing which gets its finished form by conventional means (reaming or burnishing) presents a

resistance to fracture. They also give the jewel bearing a characteristic color which distinguishes it from the unspecialized man-made sapphire. Although even the red jewel used extensively in Federal Dial Indicators, is theoretically capable of breaking, its resistance to such damage is high. A shock sufficient to cause fracture would damage many other Indicator parts as well. Consequently, the durability of this specialized jewel is certainly compatible to the application.

It is true that the plain metal bearings used in some Dial Indicators afford a slightly lower first cost. This is a marginal savings, however, and can only be realized if the Indicator sees limited service and possesses a low enough magnification so that its higher friction can be overlooked. In all normal instances, the jeweled bearing saves enough in maintenance and replacement costs to offset its somewhat higher first cost many times over.

These are the reasons why users prefer jeweled bearing Indicators ten to one over plain bearing Models and why Federal advocates jewel bearings as being your best investment in long, accurate operational life. Needless to say, the use of jewel bearings is a mark of quality, accuracy, and dependability in Dial Indicators, just as it distinguishes the finest in the watch maker's art.

OTHER CATALOGS

DIAL INDICATING GAGES
Catalog 71G

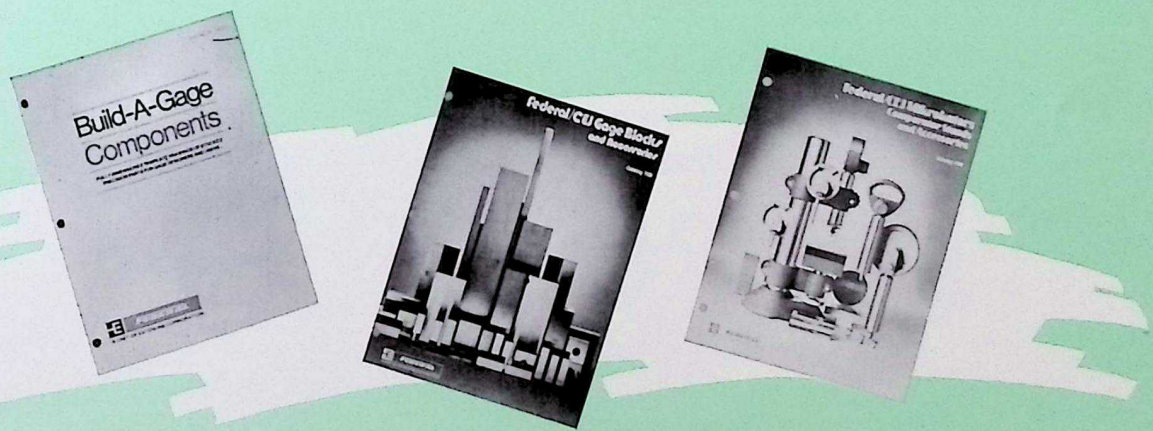
Gages for inspecting, measuring and comparing dimensions at the bench or at the machine. All these gages incorporate Federal's Miracle Movement Dial Indicators and reflect skillful design based on sound gaging principles. Described are a wide variety of models for thickness, depth, I.D., O.D., Caliper, hole location and many other types of measurement, all available from stock.

FEDERAL GRINDING GAGES
Catalog 65FG

Efficient and accurate gages for continuously measuring dimensions of cylindrical work while it is being ground. They are easily and quickly installed, work efficiently with either traverse or plunge cut grinding. Many models are available for measuring outside diameters, inside or outside width between shoulders or flanges, tapered diameters and work having splines or keyways.

AIR GAGES
Catalog 73D

Describes the efficient Dimensionair . . . the only air gage made to predetermined accuracy so it can be set using only one master. Catalog shows the many models available and the extensive variety of tooling . . . air plugs, air rings, air snaps, air bore gages, Air-Probe and Jet Probe for use in comparators and on fixtures. Shows how to gage dimensional relationships and unusual dimensions economically.



BUILD-A-GAGE COMPONENTS
Catalog 74GC

Ideal for designers of gages and inspection fixtures. Illustrates hundreds of off-the-shelf gage components and parts to make design work easier and more economical. Each item drawn to scale with toleranced dimensions; each page removable so that any drawing can be used as a tracing template. Also contains tracing templates of Federal Indicators and various gage heads.

FEDERAL/CEJ GAGE BLOCKS
Catalog 75B

Quality gage blocks from the company founded by C. E. Johansson, creator of the modern combination gage block system. A full selection of standard sizes, in sets and individual blocks, ready for immediate delivery. Both rectangular and square styles; English (Inch) and metric sizes; steel and tungsten carbide; AA, A+ and A grades. Complete range of accessories plus gage block calibration services.

FEDERAL/CEJ MIKROKATORS
Catalog 75M

Describes the super mechanical dial indicator for high precision, high magnification applications. Minimum graduations from .0002″ to .000002″, plus metric models. Unique mechanism eliminates friction — no wear, no backlash, no lost motion. Options include adjustable measuring pressure. Compact and long range models also available, plus a full selection of comparator stands and accessories.

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